THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S)

1909 EDITION

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THE EIGHT-HOURS MINES ACT AND MACHINERY.

WHATEVER the outcome of the Eight-Hours Mines Act may be as regards labour conditions generally, there is no question but that every effort will be made to maintain the present output. At some collieries the new Act will make little or no difference, as they are already working eight hours' shifts. Others, however, work nine, ten and eleven hours, and it is at these that the new Act will be more or less severely felt; and the greatest difficulty will arise in arranging the hours of labour to meet the new conditions in the counties of Durham and Northumberland, where the coal hewers are now only working seven hours (bank to bank), but where coal drawing goes on for ten hours, and where all men engaged in connection with the haulage of coal from the face to the pit bank work the same number of hours. At other collieries the coal hewers (who are always on piece-work) have no stated hours for working—except at starting—and they may work half-an-hour or an hour more than eight hours, as they please; or again, at others they may work less and go home when they please. There can be no doubt, therefore, that, whatever else may happen, the new Act is not going to benefit the miner, and there is every possibility that in some districts one of the first effects will be serious labour disturbances.

In a recent American Consular trade report, Consul Maxwell Blake deals with the question of the enhanced employment of machinery for coal-getting to balance the lessened production by manual labour, and, previous to the passing of the Act, he said: "The economic aspects of the measure become primarily involved with the subject of the application of mechanical coal-cutting appliances, for unless Parliament is able to convince itself that the curtailment of the working hours of miners would be more than offset, or at least counterbalanced, by the further adoption of mechanical power below ground, the passage of the Act will be impossible, especially since it is estimated that a 10 per cent. reduction of working hours would mean an annual shortage of 26,000 tons"; which, no doubt, is quite true, except perhaps the words "the passage of the Act will be impossible," for with our present Government "nothing is impossible." There is, however, one question that scarcely appears to have been sufficiently considered, and that is the "selling price" and its effect upon the consumer; and there appears to be little doubt that one effect of the Act will be to raise the price of coal, as it will require a certain amount of time for collieries to adjust themselves to the new conditions, and during the adjustment the output will be reduced. This, however, may only operate for a short time, and the law of "supply and demand" will to some extent regulate the amount of the rise, but the only logical conclusion one can come to is that the selling price

of coal must go up, and it is this fact that may lead to the extended use of machinery.

Generally speaking, the introduction of machinery in this country has not so much resulted in cheapening the actual cost of "getting," but rather by increasing the output in a given time, and improving the quality of the coal, has so increased the difference between the cost of production and the selling price, that seams otherwise unworkable are now worked at a profit. In many cases the difference between the cost of "hand" mining and "machine" mining is so slight that very thin seams are still being worked by the former, and in other cases the latter has been tried and found wanting. Again, the introduction of machinery is also influenced by the capital available for this purpose, and whilst many colliery companies would very much like to install machinery, the lack of the wherewithal prevents them doing so. A rise in the price of coal may result in a greater influx of capital, but it can only be so provided that the higher price will be more or less permanent.

Mr. Blake gives some interesting statistics, and points out that although coal-cutting machinery was introduced fifty years ago, in 1902 there were only 483 machines in all Great Britain, and in five years this number had increased to 1,493, and the percentage of coal obtained by machine mining was in 1902, 1·8 per cent., and in 1907, 4·8 per cent. The total output in the United Kingdom for the two years given was in 1902, 227,095,042 tons, and in 1907, 267,830,962 tons, or an increase of approximately 50 million tons, while the coal obtained by machine was in 1902, 4,161,202 tons, and in 1907, 12,877,244 tons, or an increase of only 8 million tons, which tends to prove that so far machine mining does not appear to have brought forth such brilliant results as might have been expected.

It is to be noted also that by far the greater number of machines are operated by compressed air, though electricity is making rapid headway, as in 1902, out of 483 machines, only 149 were electrically driven, whereas in 1907, out of 1493 machines, 643 were driven by electricity. This is accounted for in a great measure by the adoption of the "percussive" machine, which can only be operated by compressed air, though many such machine are worked by "compressors" driven by electricity and placed underground.

It is also interesting to compare the number of machines in this country and in the United States of America, as in the latter country in 1906 there were 10,212 machines in use, which obtained no less than 35 per cent. of the output. Each machine had an average of 11,638 tons, as against 8,630 tons in this country. Mr. Blake also points out that although Great Britain produced more coal than the United States ten years ago, the latter country has now exceeded the former by 60 per cent.; and not only this, but to show the effectiveness of coal-cutting machinery, while there were 1,059,028 persons employed at the mines in Great Britain, there were but 640,000 similarly employed in the United States for a 60 per cent. greater output.

At first sight the above appears to be a clear case for the effectiveness of machinery, but the difference in the labour conditions of the countries largely accounts for the more extended use of machinery in the States. In Great Britain the coal is in all probability obtained for a less cost per ton by hand labour than is obtained in the United States by machine mining, and as already pointed out, the real reason why machinery has not been more largely introduced in this country is that the margin between the cost of hand mining and machine mining is so small that British colliery managers have not considered the saving a sufficient justification for the capital expenditure. A compressed air "percussive" type of machine costs from £60 to £70, whilst the "longwall" type machines cost from £250 to £500 each, depending upon the size; so that for the latter type machines, either electrically or compressed-air driven, the initial cost of installation—especially where power plant has to be installed—means a serious consideration. Improvements, however, are slowly being effected, and experience is being gained which may do much, not only to prevent the working and maintenance cost—which has often been a serious matter in the past—being unreasonably high, but also to increase their rate of working, and so produce a greater earning power; and it is to the manufacturing side of coal-cutting plant, quite as much as to the enterprise and energy of the British coal-owner and colliery manager, that we must look for the maintenance of the present output, and the prevention of undue hardship which "dear" coal is sure to occasion.

The Diesel Engine.

A THOROUGHLY commercial spirit dominated last week's meeting of the Electricals, the price of the Diesel engine and its fuel being much to the fore; Mr. Pfeiffer, who read a paper favouring the Diesel, is to be congratulated on having drawn so many actual and would-be—had time permitted—speakers.

The working efficiency of the Diesel engine cannot be questioned, but its first cost is admittedly high—as much as or more than that of a good engine and boiler; morever, the price of oil fuel is a fluctuating quantity, varying, according to one speaker, from 30s. to 90s. per ton.

However, judging by the results obtained at Leatherhead in 1908 with fuel averaging 70s. per ton, the adverse effect of price fluctuations may easily be exaggerated. One factor in connection with the adoption of the Diesel engine which Mr. Pfeiffer did not emphasise is the possibility of legal trouble over nuisances, real or imaginary. These have occurred in the past, and would probably influence any decision regarding the adoption of small Diesel engine-driven plants wholesale in populous districts in place of the usual electrical sub-station system, more than the fractional cost which the author showed in their favour in making a comparison with the present L.C.C. electrical system, based on Mr. Rider's recent paper. True, that gentleman turned the balance in favour of his own plant, in view of the more economical working now obtaining, but the author has the last word in this matter, and it should be an easy matter on paper to show up the Deisel engine still more favourably.

Meanwhile, the Charing Cross Co., having adopted the Diesel engine in its sub-stations, is probably in a position to say a good deal, which it may do—some day.

The Halfpenny Fare.

IF there is one thing more than another which Labour Councils take a delight in advocating, it is halfpenny fares on tramways. The early workman, the female worker and the children are the special subjects of their appeals.

Occasionally, tramway authorities have allowed their generosity to outrun their discretion, and the result has generally made poor reading.

Recently the Manchester Tramways Committee has, as a result of the usual agitation, obtained a comprehensive report from its general manager, Mr. J. M. McElroy, on the same subject, and his conclusions, based on Manchester conditions, are much in accord with those generally held.

Mr. McElroy points out that in Manchester there is a clearly defined inward and outward rush of traffic in the morning and evening respectively, and that the addition of a large number of halfpenny passengers at those times would lead to the necessity of increasing the car accommodation and power plant solely for that purpose, a state of affairs which—considered in conjunction with the certain loss of revenue by substitution of ½d. for 1d. fares, with stages of ¾ to 1 mile in length—could only lead to financial loss.

Moreover, in Glasgow, where the population is congested and conditions are more favourable, owing to the steadier traffic conditions, Mr. Dalrymple has recorded his opinion that the halfpenny passengers are carried at less than cost price, and this with fare stages of about ½ mile.

Mr. McElroy says :—"If we adopted ½-mile penny stages we may assume that a large number—say half those who now travel three-quarters of a mile—would walk to the half-mile halfpenny stage, and hence we may estimate that the introduction of halfpenny stages would transfer 15 per cent. of penny passengers to the halfpenny class and reduce the revenue by £32,106 per annum. To neutralise the effect of this, we should have to carry an additional 15 million halfpenny passengers."

The report points out that decentralisation of the working population is more likely to be secured by offering specially cheap fares for long distances. Workmen's fares are in force in Manchester up to 7 a.m., and available for return at any time, the average fare being ·280d. per mile, or half ordinary rates, and an extension of time to 8.30 a.m., as suggested by the Gorton Labour Council, would, it is estimated, cost the department £20,000 per annum ; the City Council has, however, adopted certain recommendations contained in the report for reducing long-distance fares, *i.e.*, all those beyond the first penny stages from the centre of the city. In conclusion, Manchester ratepayers will be well advised to remember that the present balance of tramway income over expenditure is only ·09d. per passenger, a comparatively small margin. It is true that this sufficed to aid the rates to the extent of £70,000 last year, and doubtless this is sufficient to account for proposals which would tend to divert it in favour of one class as opposed to the ratepayers in general.

New Source of Peat Fuel.

"There is nothing so coy as capital, and if it is to be won it must be by convincing arguments, and not by the doubtful pleadings of conflicting interests." We quote the above sentence from the able Presidential address recently delivered by Mr. J. A. F. Aspinall before the Institution of Mechanical Engineers. The subject of the address was the electrification of railways, which he selected because it would sooner or later lead to a distribution of work amongst engineers.

Engineers are not alone in looking forward to the electrification of railways. Manufacturers and contractors are equally justified in expecting their share of work and profit in the transformation which must surely come, and so far as can be gathered from an advertisement in the *Times* of the 18th inst., must come rather sooner than later. The advertisement occupies two columns, is headed "New Source of Coal Fuel," and is based on a paper read by Dr. Martin Ekenberg, Ph.D., before the Iron and Steel Institute, on Friday last. We gather from the advertisement that Dr. Ekenberg's paper "dealt with a subject of vast importance," and gave full details of a new process whereby "the conversion of peat into fuel has been rendered for the first time practicable." With the reminder that we are not quoting from the paper itself, but only from the advertisement, we may say that "like most of the great inventions from which mankind has so largely benefited, the new process . . . . is a very simple one," and those who are sufficiently interested may be referred to the quoted source to learn the outlines of the process.

The benefits in store for mankind are substantial, numerous and varied. Existing gas works will be able to increase their output by 50 per cent. without extension of buildings or plant; Europe will be independent of the Chilian nitrate supply, and, lastly, it will effect the electrification of railways, because "each peat bog could form a site for the erection of a power station," and "as peat bogs are mostly universal, it would thus be easy to electrify railways; in fact, there are at present several such projects under consideration."

Now that it becomes "easy to electrify railways," not only engineers and manufacturers may look forward to the conversion of existing lines to electrical working, but contractors may also anticipate orders for possible diversions of routes, so as to take advantage of the peat bogs which, though "mostly universal," may not, in all cases, be conveniently situated. This railway electrification, so important to our readers and ourselves, is but a side issue—a by-product so to speak—in the revolutionising effect of the momentous discovery. "There are, for example, many European nations who at present depend more or less upon Great Britain for their coal supply, and should that fail them from any cause, the result to their trade and commerce would be most disastrous," whilst "the commercial value of the new peat fuel would be enormous during a European conflict, when coal would become contraband of war," so that a "twofold advantage" would accrue to "Protectionist States," since they would be able "to fall back upon their own resources." Unlike most writers on economic subjects, the author of the advertisement realises that a cessation of imports by B must also mean a cessation of exports by A, and being strongly imbued with British aspirations he seeks a "measure of compensation for the loss sustained on coal exports." He finds it in the fact "that the control of the rights of the new process will be in British hands." This "source of satisfaction" will, of course, be shared by all right-minded British patriots as well as—perhaps even more than—those more immediately concerned, for the peroration shows that that popular form of investment which combines 5 per cent. with philanthrophy is mean and paltry when compared with the opportunity which Dr. Ekenberg's simple discovery affords. It is "hoped that the parties profiting by the new industry may be guided not merely by the desire to create a dividend-paying monopoly, but by the loftier aim of furthering British influence in all the countries with whom they may enter into commercial relations."

The advertisement contains no indication of origin, and no address to which anxious inquirers can send their communications, but these omissions will doubtless be rectified at some subsequent date. We may reasonably infer that capital will be required to acquire the patents or develop the process, and in the words we have quoted from a serious engineer, "capital is coy." "Convincing arguments" are needed when it is to be won for undertakings having for their object merely a fair return on the investment, whilst "doubtful pleadings" have sometimes sufficed to win coy capital for projects replete with "lofty aims" and sadly deficient in sordid commercial returns. Perhaps the loftiest aim to which mortal can aspire is the attainment of the attribute of unselfishness, and it may be hoped that the British investor will be sufficiently high-minded to cultivate it in such a case as this. Why should not the inhabitants of the "Protectionist States" of the Continent of Europe be allowed to "fall back upon their own resources" in the provision of capital for the exploitation of such a "dividend-earning monopoly?" We recommend that they should. It is, of course, possible that the unselfish attitude might never receive the recognition it deserved, but that is often the penalty of lofty aims, and other occasions may conceivably arise for the patriotic dissemination of British influence.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Heating in Laundries.

We notice from a report in your journal (page 764) of a paper recently read before the Scottish Laundry Association in Glasgow, dealing with the subject of electricity in laundries, that the author made the statement that electricity for heating could only be applied in laundries to one department, viz., hand ironing.

We can assure him that it can also be most successfully applied to many machines, both rotary and reciprocating, as we have converted a considerable number, originally designed for gas heating, including body ironers, collar and cuff ironers, large machine irons up to 40 lb. weight, and several other special appliances which were a failure with either gas or steam heating. All these have proved highly satisfactory with electricity as the heating agent.

Eastman & Warne.

London, W., *May 11th*, 1909.

Mercury Motor Meters.

Mr. Schofield's letter on this subject requires some comment, as his statements are liable to make an erroneous impression.

The decision of the so-called "premier firm of commutator meter makers" to place a mercury meter on the British market is hardly conclusive evidence of their convictions regarding the superiority of that type of meter, inasmuch as the large American company which, to a great extent, controls this British company, has so far not considered it advisable to manufacture any but commutator meters for continuous-current supply, and this notwithstanding the fact that they sell several times as many meters as all the English makers combined.

The fact of the matter is, that the low-speed low-torque mercury meter is an essentially English product, which would never have taken a hold on the market if the commutator meter had already been fully developed, and the faults of the early types had been eradicated.

A carefully designed commutator meter insulated to suit this climate, running at *any* desired speed, and provided with a gold commutator, has a much higher torque than any mercury meter, and can be guaranteed to remain accurate on a single lamp for an indefinite period.

The Electrical Apparatus Co., Ltd.
pp. E.B.S.

London, S.W., *May 11th*, 1909.

"Strebor" invited caustic criticism in his first letter in your issue of 27th ult. He suggested that a current of definite value of a 20-volt battery was not the same as a current of equal definite value of a 220-volt supply when applied to an ampere-hour meter, hence my reference to elementary study.

There has been so much criticism of mercury meters in your columns of late, that it is really difficult to restrain the impression that the letters are issued indirectly by makers of less successful types, and "Strebor's" difficulty is perhaps more apparent than real, as I shall no doubt be able to prove when I have the pleasure of meeting him, because I am "interested" in all types.

I should esteem it a favour if he would communicate with me direct, as I expect to be away for some time.

"Mercurio's" particular phenomena could, no doubt, be explained in a few minutes by the representative of the makers of the meter. It is not an inherent fault of the mercury type. The remainder of his letter is really a reproduction of a letter extensively circulated on the Continent to counteract the very successful introduction of the mercury type there.

If "Mercurio" will communicate with me, I will endeavour to satisfactorily clear up one or two hazy points he refers to.

In my opinion, questions of this nature should be referred to the manufacturers in preference to public discussion, as the latter method is apt to suggest to your world-wide readers a fault in a particular type instead of in an isolated meter.

R. H. Schofield.

Hollinwood, *May 17th*, 1909.

[We have no reason to believe that Mr. Schofield's impression as to the origin of the letters on this subject is in any way justified. As regards the subject of this correspondence, we may point out that the observation of a phenomenon is one thing—its explanation is a totally different thing. Newton observed the phenomenon of gravitation, and drew attention to the matter, but to this day no one has been able to explain it. In the same way, we see no reason to doubt the facts reported by "Strebor," and corroborated by "Mercurio," and with them we await an explanation of the peculiar behaviour of the meters in question. It may be quite a simple one, totally independent of the source of the current.—Eds. E.R.]

Capital and Labour.

In Electrical Review for May 14th you quote some remarks made by Sir Benjamin Browne in the *Iron and Steel Times*. It is well to be reminded now and again of the close connection these two factors must have if there are to be any benefits derived from their possession and use. The third factor which is brought into question (enterprise or management) is often the cause of much of the friction and waste that is constantly going on between the other two factors. I think he would have been more near the mark had he said that capital and labour were of little value without enterprise or management.

In the same issue you mention the Brush Co.'s report. It would be hard (in my opinion) to find a more fitting example of the above than this company. Perhaps your readers will remember that some few years ago the Brush Co. were engaged in a dispute with some of their employés over a wages question. About the same time, you reported some remarks made by one of the officials of the company to the effect that workmen were unreasonable to expect such high wages (the rate obtained in other districts), which prevented manufacturers paying dividends, and it was better for the men to accept the lower rate, as manufacturers would not keep their works going if no dividends were to be gained, and, as a result, there would be no work for the men, consequently no wages.

Perhaps Lord Vaux made a mistake when he spoke of foreign competition, &c., and meant increased wages paid to their employés? At the time of the dispute, other firms were paying a good dividend to their shareholders and a good rate to their workmen. I don't know for certain, but I believe the ordinary shareholder of the Brush Co. received nothing in the way of dividend, although it was a prosperous year for many other firms.

Now, Mr. Editor, you have told us the then and now of the Brush Co.'s policy, can you go one step further and tell them what to expect? This, I know, is a big task.

Reviewing the above, it appears to me that it is the management that requires a tonic, and the sooner they get it the better for the shareholders. We have heard or read various causes of the absence of dividends, and although I have no brief for Trade Unions, I do not think managers and others will persuade the Trade Unions to allow them to make dividends out of their members' wages. If this is the way masters expect to fill their coffers, they deserve all the trouble they get. I, for one, do not think they do, although, no doubt, there are some few who would do so. Neither do I think the Brush Co. do, but being in a bad way they could not help themselves, and though the men may have deserved the advance, it was hardly the time to ask for it.

At the time I read the report I treated it as a cover for something else which, in my opinion, is the management, for, if they have the capital, they ought to make it pay, and if they have not sufficient capital, they should not enter for the class of work they do. I think a great many firms have

failed through those at the head of affairs failing to make the best use of the capital and labour at hand, and then seeking to make labour pay for their failures. I hope the next thing that troubles the Brush Co. and their shareholders will be income-tax from

Enterprise.

Municipal Trading: Unfair Competition.

In reference to the second paragraph (page 790) of your leader on "Municipal Trading," the writer of the article appears to be under an unaccountable misapprehension. It is surely well known that the whole telegraph system of the United Kingdom is in the hands of the State, and, this being the case, no one except an officer of the department could possibly possess such a knowledge of the apparatus in use as would enable him to teach on the subject. If it were forbidden for the teaching to be so conducted, the result would be that no classes could be held, unless, indeed, the teaching consisted of a mere outline of the general principles of telegraphy, which would certainly not be considered satisfactory. The difficulty is not that there is a superfluity of teachers anxious to teach, who are kept out by the unfair competition of Post Office engineers, but that it is difficult to obtain teachers at all, owing to the pressure of departmental work, and the amount of travelling which has to be done, making it difficult for competent men to obtain spare time (after office hours) for the purpose of teaching. The grievance (of unfair competition) is, in this case, a purely imaginary one.

Post Office.

[The paragraph to which "Post Office" takes exception reads as follows:—"Staff engineers in the Post Office department have been permitted to swell the ranks of the technical teacher, a miserably underpaid profession." Nothing whatever is said about the teaching of telegraphy. Does "Post Office" maintain that this is the only subject for which Post Office employés compete with technical teachers? Do they never by any chance teach telephony and the general principles of electricity and magnetism and of electrical engineering?

But, to take up our correspondent's point and confine ourselves for the moment to telegraphy, how much that is special and known only to "an official of the department" is comprised in a course of instruction in telegraphy? A reference to the City and Guilds syllabus shows us that in the section "Telegraphy and Telephony" there is very little indeed that is not taught every day by the technical teacher who has not the advantage of being a State servant. "The fundamental principles of electricity and magnetism in their application to telegraphy, units of measurement, primary and secondary batteries, galvanometers, shunts, condensers, resistance coils,"—to mention only a few of the subjects enumerated—is a knowledge of these subjects the sole monopoly of "officers of the department?"

We have no wish to single out the Post Office official as a specially bad case, we referred to him only as an example among others which occurred to us at the time of writing. The point of our article was that there is something fundamentally unjust in a system which permits a State or a municipal servant to compete in the open market with the private individual whose rates and taxes go in part to provide not only the salaries, but also the pensions of his rate-aided competitors.—Eds. E.R.].

Penny-a-word Telegrams.—A firm of agents writing to the *Times Engineering Supplement* on this subject expresses the belief that an invention in which it is interested will shortly enable a speed far above 60,000 words per hour to be attained over long-distance cables, at a reduced cost. This is to be effected by a combination of the phonograph, microphone, and telephone receiver, and obscure references are made to the ability of the human ear to receive 30,000 vibrations per second. We do not know what the firm in question is driving at; but we can assure it that a submarine cable of any considerable length will be as deaf as a post to the 300 pulses per second, which approximately represent the transmission of even 60,000 words an hour. The inventor of this device appears to have got hold of the wrong end of the stick.

PROCEEDINGS OF INSTITUTIONS.

The Electrification of Railways.

By J. A. F. Aspinall.

(*Abstract of Presidential Address delivered before the* Institution of Mechanical Engineers, *April 23rd*, 1909.)

No engineering subject requires more thoughtful care than the mechanical and electrical working of railways. The "battle of the systems" has had the effect of causing railway companies to defer electrification until engineers agree as to the system to be adopted. While there are cases in which conversion can be undertaken with great commercial success, each individual case must be considered with the utmost care on its own merits.

The L. & Y. Co. had gone into the work not to save money, but to make money; it enabled them to defer for a long time any increase in the capacity of their terminal stations, for, by using motor-car trains instead of locomotives, they doubled the capacity.

To warrant the electrical equipment of a main line operated at high speeds for long distances without a stop, some great commercial advantage must be shown. To run trains at 120 m.p.h. would be of little benefit to the traveller, while the increased cost to the railway would be enormous. In addition to the great first cost, the usefulness to the railway company of the track would be materially reduced, as the margins of time before the approach of such trains would have to be increased, and the earning capacity of the express track would be diminished. In the case of many suburban lines in our great cities, however, electrification will at once double the train-carrying capacity of the tracks. An increase of speed and frequency of trains in a populous district will soon create traffic, but will cost money; where traffic has been taken away by parallel lines of tramway, electrification of the railway will bring back large numbers of passengers; but unless an electrified railway can be continued for some distance so as to earn a good average fare, stations close together and near the city will yield very low fares. The main object should be to induce a large number of people who have business in the towns to live further out, and so bring up the average fare to a profitable figure, leaving the very short-distance traffic to the tramway.

On the Liverpool-Southport Electric Railway the conditions were very favourable to the development of additional traffic. For four miles there are four tracks, all in use when steam was employed; now two suffice, though the frequency of trains has been more than doubled, the idle platforms, &c., have been shut up, and the spare lines are used for the steam-worked goods traffic. During the first year of electrification, when the increased service had attracted 14 per cent. more passengers, the total weight of rolling stock moved in a day was 69,160 tons, as compared with 78,393 tons when steam was used.

The suburban service on the Liverpool and Southport electric line is considered the fastest of this character in existence. The stopping trains run 18½ miles in 37 minutes, stopping 14 times; the express trains cover the distance in 25 minutes. The trains are running at 30 m.p.h. in 30 seconds from starting.

The six-wheeled coupled tank engines which did the work in 1904, consumed 80 lb. of coal per train-mile with express trains, and 100 lb. with stopping trains, the excessive value being due to the high acceleration required. The consumption of coal at the power station in 1908 was 49 lb. per train-mile, and the energy consumed at the train was 49 watt-hours per ton-mile for the express trains, and 112 watt-hours per ton-mile for express and stopping trains, including all shunting work. All goods trains are still worked with steam locomotives.

The work of conversion was carried out very rapidly, to reduce interference with existing traffic and to avoid loss of interest on idle capital; the order was given on October 22nd, 1902, the power station was working on December 20th, 1903, and electrical operation commenced on March 22nd, 1904.

The method of rating railways in vogue has the effect of reducing the rates when steam locomotives are used, but increasing them when a power station is put down.

With regard to the position of the conductor rails; at a meeting at the Railway Clearing House in 1903, it was decided that the third rail should stand 3 in. above the track rails, and 3 ft. 11½ in. from the centre of the track. The protection boards, where necessary, are 8 in. apart and 1 in. above the rail. In the London district the horizontal distance has not been rigidly adhered to, but the height has been generally accepted. The position of the rail is closely limited by existing gauge rules, and the inverted rail used on the New York Central could not possibly be employed in England, without immense alterations in bridge girders and platforms. The fourth or return rail is in London raised 1½ in. above the track rails; on the Liverpool-Southport line it is below the level of the track rails, is not insulated, and has no shoe in contact with it, the return being effected by way of the wheels and track rails, which are bonded to the fourth rail. This has the advantage that any single length of fourth rail or track rail can be taken out for repairs without affecting the trains in the next block section. Serious loss by corrosion of the fourth rail, and by abrasion and corrosion of the third rail, has been observed, and all these rails are now carefully painted.

The wear of track rails on electric railways has been found to be extremely heavy; this is due to the low centre of gravity of the motor trucks, as the result of which the resultant pressure on the outer rail at curves is carried largely by the flange instead of the tread of the wheel. Only about half the weight of the motor is spring-borne, and the total weight not spring-borne amounts to about 3 tons per axle; a motor-car weighs 46 tons 7 cwt., of which

12 tons is not carried by the springs. By employing suitable mechanism for transmitting the driving power to the axles, the whole of the weight except that of the wheels, axles, and axle-boxes, could be supported by springs, and the centre of gravity raised well above the frames; but this would block the passage from car to car, and the great advantages of the direct drive would be lost. As the gears wear extremely well, it may be preferable to wear out the cheap rail rather than expensive mechanism; and it must be remembered that the steam trains have never been operated on the faster schedules with high acceleration and de-celleration that are frequently adopted with electric trains, so that there is no information as to how the tracks would have been affected had this been possible. The weight of the motive-power of an electric train being distributed over a larger number of wheels, and the motive-power being perfectly balanced, the electric train must have less damaging effect upon the permanent way than steam trains, other conditions being equal.

The centre of gravity of the motor bogie is 1 ft. 10 in., and of the motor-car 3 ft. 9 in. above the track in the Liverpool-Southport cars; that of a trailer car is 4 ft. 8 in., and that of a 10-wheeled bogie passenger engine 5 ft. 6 in. above the track.

The construction of the cars is a matter of considerable importance, in view of the necessity of avoiding delays at stations. A multiplicity of side doors requires a larger staff on the platforms; the American system requires an excessive train staff. The plan found most successful on the L. & Y. line is that of having large side doors at each end of a 60-ft. car, opened and closed by the public; with this arrangement the most crowded cars are always emptied during the rush hours in about 50 seconds at terminal stations, while intermediate stops only require 15 seconds. Express trains are worked by a driver and a guard only; stopping trains have an additional guard.

The line was operated by steam with 130 locomotives, and 152 carriages with 5,084 seats; now there are 38 motor and 53 trailer cars, with 5,814 seats. Special features of the system are direct control of the equipment (not multiple-unit control), the use of the automatic vacuum brake, and carriages 10 ft. wide.

High platforms are desirable, to facilitate ingress and egress, and the passengers should be induced to enter the car at the rear and leave it at the front door, at intermediate stations, a system which leads to rapid loading and avoids confusion.

The use of large main controllers, handling a maximum of 2,400 amperes during the period of acceleration, has been found highly satisfactory; maintenance costs have been very small, and inspection is easy, as the whole of the control equipment for eight 150-H.P. motors is contained in two drivers' compartments.

Regarding the feeder cables, experience on the Liverpool and Southport line is unfavourable to laying them solid in the 6-ft. way; bare wires carried overhead in open districts would be cheaper, always visible, and easier to repair. Where, however, there are many other overhead circuits, line crossings, &c., cables are safer. For the high-tension line between Aintree and Seaforth the cost per mile of the overhead equipment was £1,300, and that of the cable line £2,030, the cost per kilowatt transmitted per mile being for overhead £1 25, for cable £2·67, on the basis of 500 amperes per sq. in.

The fluctuations of load on the system were found to be extremely heavy, and in 1905 it was decided to install batteries, not only to steady the load but also to ensure the continuity of the whole service for at least one hour, in case of serious breakdown at the generating station.

The latter originally contained four 1,500-KW. sets and one of 750 KW., and there were four sub-stations, containing 15 600-KW. rotaries, to run 12 trains, each of which during acceleration took up to 1,200 KW. It was necessary to run plant of 5,250 KW., though the average load was only 3,500 KW. The wide and rapid variations of load threw severe stresses on the engines due to temperature changes, and led to uneconomical working. As the traffic had increased, and the voltage regulation was poor, the battery sub-stations were interposed between the rotary sub-stations. The results have amply justified the policy adopted, the momentary peaks were reduced from 7,000 to 4,500 KW., and the peak during the rush hours from 3,800 KW. to 3,100, so that the load can be carried in winter with plant of 4,500 KW., and in summer with 3,750 KW.

The batteries installed were of 1,000 to 1,600 A.H. capacity at the 1-hour rate, according to situation, and were capable of being charged at a maximum continuous rate of 500-800 A., or discharged at 1,250-2,000 A.; the maximum charge for one minute was 750-1,200 A., discharge 2,500-4,000 A., and the maximum charge for 15 seconds was equal to the 1-hour rate of discharge. The guaranteed efficiency was 85 per cent. ampere-hours, 75 per cent. watt-hours, and the batteries were controlled by automatic boosters. Tests made in 1907 showed that 14 per cent. of the total rotary sub-station D.C. output passed through the batteries, the total loss due to the latter being 3·5 per cent. of the D.C. output.

The batteries have proved a valuable standby in cases of break-down in the sub-stations, or when special trains were to be run during hours of shut-down, and the coal consumption has been reduced by 8·5 per cent., the consumption becoming 0·412 lb. per ton-mile.

In 1906 the overall efficiency was tested, and it was found that of the power-house output, 1·97 per cent. was lost in the cables, 2·95 in transformers, 5·37 in rotaries—total, 10·29 per cent., the over-all efficiency being 89·7 per cent. The losses in the live rails were calculated at 9 per cent. of the sub-station output; the total efficiency from A.C. bus-bars to the circuit-breakers on the trains was about 81 per cent. The coal consumption per unit delivered to the third rail for 1908 was 3·28 lb.

Periodical examination of the electrical equipment by special men has been found of the greatest importance.

In 1907 the lines leading to Aintree were electrified, and a very large traffic which had passed to the parallel municipal tramway line was recovered. Through trains are run from Aintree to Dingle, on the Liverpool Overhead Railway, and, in the summer-time, from Dingle to Southport. During the races at Aintree, on the Grand National day, 13,000 people leave Exchange Station, Liverpool, between 11.15 a.m. and 2 p.m., and on their return after 4.30 p.m., there is a rush. To cope with this at moderate cost, the race trains are made up of two electric motor-cars, with ten of the old coaches between them.

Any railway company having its own plant, with cheap water and coal, should be able to generate at a works cost of less than 0·25d. per unit, consuming under 3 lb. of coal per A.C. unit. At this rate, it is possible to work a high-speed service such as that of the L. & Y. at 9·5d. per train-mile. The cost per car-mile varies between 2·75d. and 3d. The total cost of energy, including the depreciation of batteries, amounts to 4·52d. No sum is here included for interest and depreciation of plant, or for maintenance of track, stations, platform staff, or other ordinary railway items, but if the cost of maintenance of track is increased, the difference must be added to the cost of electrical working.

The two motor-cars per train cost twice as much as one steam locomotive, and the annual maintenance of one motor-car is more than that of a locomotive; but the motor-car runs 50,000 miles per annum, as against the locomotive, 20,000. Thus the cost per train-mile becomes less for the electric motor-car. Brake gear is an expensive item, being constantly in use, and the author hopes that some simple form of regenerative control will be developed. Controllers, commutators, steel spur-gearing, and the third rail give no trouble whatever. The author concludes that there are a number of suburban lines round our great cities which can be electrified with advantage to the public and to the railway companies; long-distance travelling must wait awhile.

In appendices a large number of data relating to various features of electric railway operation are given.

The effect of high schedule speeds on operation and costs is shown by the following table:—

Schedule, including stops. M.P.H.	Distance between stations. 1 mile.	2 miles.	3 miles.
	Percentage watt-hours per ton-mile.		
30·0 ...	100·0	100·0	100·0
27·5 ...	71·1	66·3	73·0
25·0 ...	48·6	48·15	54·9

With two motor-cars and two trailers, during acceleration in the series connection, the average useful kilowatts = 230; energy used, 0·638 KW.-hour; average power supplied to train, 810 KW.; total energy supplied, 2·22 KW.-hours.; loss in rheostats, 71·30 per cent. In the parallel position, these figures become 833 KW., 2·27 units, useful; 1,143 KW., 3·177 units, total; loss, 27·10 per cent. The percentage loss, series and parallel, is 50·2, and in a run of 1 mile the percentage loss is 16·18.

Experiments on acceleration and train resistance showed that the maximum speed of a four-car train was 49·25 M.P.H.; a speed of 10 M.P.H. was attained in 7·5 seconds; 20, in 15 seconds; 30, in 29 seconds; 40, in 65 seconds. After 1½ minutes the speed was 43·75 M.P.H.; 2 minutes, 46·5; 2½ minutes, 48·2; 3 minutes, 49·2 M.P.H. The mean acceleration up to 10 or 20 M.P.H. was 1·94 ft. per second; up to 30 M.P.H. it was 1·51.

With a four-car train weighing 143·275 tons, and 248½ ft. in length, the train resistance in pounds per ton was found to be as follows:—

Speed ...	...	5	10	15	20	25	30	35	40	45
Resistance	...	6·5	6·0	6·5	7·25	8·5	9·25	10·0	11·0	12·0

As an example of the cost of maintenance of the motive power portion of electric rolling stock, in the half-year ending December, 1908, the number of motor-cars was 64, and the number of motors 228; wages amounted to £4,362, or 0·191d. per motor-mile; materials cost £3,119, or 0·136d. per motor-mile. The total cost per motor was £32·8, and this was lower than in any previous half-year since 1905. The amount of oil used per 1,000 motor-miles was 0·777 gallon, and the average number of miles run per motor-car per annum was 48,598. The mileage run between overhauls was, in the same half-year, bogies, 28,500; wheels, 30,300; armatures, 171,030; armature bearings, 87,100; life of brushes, 10,900; life of shoes, 102,000; life of brake-blocks, 2,650. The commutators lose about 0·003 in. diameter per 1,000 miles, and their life will probably be about 12 years.

Roentgen Society.

At the meeting of the Roentgen Society on May 6th, Dr. G. H. Rodman read a paper upon the historical X-ray tubes which the Society has now gathered together and placed in the Victoria and Albert Museum in South Kensington. Over 60 tubes have been collected from British and foreign workers, and each of them has some distinct refinement or peculiarity entitling it to a place in the exhibition.

At the same meeting Mr. J. H. Gardiner read a further paper upon the subject which was alluded to in our report of the April meeting of the Roentgen Society, namely, the prolonging of the life of an X-ray tube by attaching a small magnet outside the tube close to the edge of the cathode. By this means he suggested that when one spot on the anti-cathode surface had been fused, the focus could be made to fall on a new place and the tube be used again. Following up the criticisms of Mr. Campbell Swinton and others that the proposed displacement of focus would destroy the radio-

graphic definition, Mr. Gardiner stated that he had since made some careful experiments on this subject. He took for his subject a sheet of iron perforated with fine holes, and made an exposure with the normal focus, then with a magnet caused the focus to be drawn three millimetres to one side of the normal focus on the anti-cathode and made another exposure, and finally made a third exposure with the cathode focus again deflected about the same distance on the other side of the normal focus. On development, the three images of the perforated screen were absolutely identical in sharpness, the definition being equally good, whether the cathode focus fell naturally upon the anti-cathode or was displaced by the magnet to one or the other side. He concluded, therefore, that many new parts of the anti-cathode surface might in this manner be exposed to the cathode focus without any loss of definition.

Another paper read at the same meeting was by Mr. G. W. Raffety, on the subject of tubes with anti-cathodes of various metals. He disclaimed to have any medical knowledge, but he said that it had occurred to him several times lately that the modern focus-tube with its dense anti-cathode, constructed with the object of taking the heavy discharges necessitated by the requirements of radiography and screen work, might not be the best for medical—*i.e.*, therapeutic—purposes. The material of which the anti-cathode is composed has a marked influence in determining the nature of the emitted radiation. What he termed the peculiar "individuality" which was impressed on the radiation by any particular anti-cathode hinted at the possibility, he thought, that the Roentgen rays might originate from the atoms of the anti-cathode themselves, and that the negative acceleration of the electrons of the cathode stream, instead of being the primary cause, might be merely instrumental in causing an emission of radiation, the exact nature of which was determined by the physical characteristics of the atoms receiving bombardment. Mr. Raffety showed an experimental tube in which a platinum-faced anti-cathode was hinged to one of aluminium, so that it could be moved out of the way of the cathode stream.

In the course of the discussion the opinion was expressed that it was a golden rule with the electrodes, both anti-cathode and cathode, in a tube, that if good definition were desired they should be absolutely rigid, and it was feared that the hinge arrangement would cause trouble, all sorts of vibrations being set up.

Electricity Works and Refuse Destructors.

By J. A. Robertson, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Glasgow, April 13th, 1909.*)

A combined installation has been put down at Greenock to the author's design, and has been in operation during the past year; in this paper the author gives the results of his experience. He emphasises the importance of regarding the destruction of refuse as primarily a sanitary measure, and deprecates the tendency to give undue prominence to the commercial aspect of the matter; stewing and sorting refuse is a most objectionable practice.

The first condition for success is that the demand for energy shall be fairly steady, so as to obviate storage of refuse or by-passing the furnace gases to the chimney at times of light load. A residential district is, therefore, not very suitable for a combined installation; a power or tramway load is desirable.

On the average, from 15 cwt. to 1 ton of refuse is collected per day per 1,000 inhabitants; its value varies with the district and season, ranging at Greenock from 86 units per ton in October to 24 in July, when the supply is also at its lowest. The fluctuation in the quality of the refuse is the greatest drawback to its use, necessitating stand-by coal-fired boilers to maintain steady steam pressure. Trouble from dust in the power station arises mainly from crushing and screening clinker, and can be avoided by suitable arrangement of the buildings. Nuisance from the emission of dust or offensive gases from the chimney should not be possible in a modern plant.

Feeding the furnaces by hand is an undesirable method on account of the amount of labour involved, the cooling of the furnaces and the sanitary objections. At Greenock the automatic "tub-feed" system has been adopted, in which the refuse is tipped into skips each containing one cartload; the skips are lifted by an electric crane to a storage platform over the clinkering floor. To charge a furnace, a skip is placed on a movable cradle over the furnace opening, which is fitted with a water-sealed door; the weight of the skip actuates a system of levers and balance weights by means of which the door is removed, the contents of the skip deposited in the furnace, and the door replaced automatically, the whole operation taking less than one minute. The whole of the work can be done by one crane-man.*

The author prefers fan draught to steam jets, on the score of economy, quality of clinker, and facility for economising by heating the air supply with the waste gases. At Greenock the draught pressure is 6 in. of water, and the air is heated by passing it through side boxes in the furnace between the brickwork and the grate; this method of heating, however, is not very effectual. In Richmond, U.S.A., Messrs. Heenan & Froude have adopted a plan for heating the air by passing it through the hot clinker freshly withdrawn from the furnace, which, at the same time, cools the clinker and facilitates its removal.

The Lancashire boiler presents advantages due to its large water capacity, which compensates to some extent for the unequal quality of the fuel. This advantage disappears when coal-fired boilers are also in use, and the water-tube type is more easily kept clean. The marine type of water-tube boiler is employed at Greenock, supplied with feed-water from the economiser at 300° F., and generating steam superheated to 550° F. Dust in the boiler is frequently the cause of poor results, due to the loss of effective heating surface.

Careful and skilled management is essential to securing high efficiency and hard clinker; the latter can only be obtained when the fire is kept burning for some time after the maximum temperature has been attained. The department which uses the steam should have the control over its production.

In Liverpool over nine million units were generated from refuse in 1907, using non-condensing engines that took 50 lb. of steam per kw.-hour: in most cases the fuel costs of combined stations are lower than those of stations run on coal. Liverpool only pays 0·2d. per unit for energy generated from refuse.

While it is exceedingly difficult to appraise the value of the destructor steam with accuracy, the author believes that there is in most cases a saving to both departments due to combined supervision, reduced cost of the single site as compared with two sites, saving in buildings and in some items of the steam-raising plant. At Greenock the generating station had been run on coal for three months before the destructor commenced working, so that an accurate comparison of running costs was possible. The allocation of costs was made on the basis of 4½ lb. of coal per unit generated, with coal at 10s. per ton, and after allowing for capital charges on

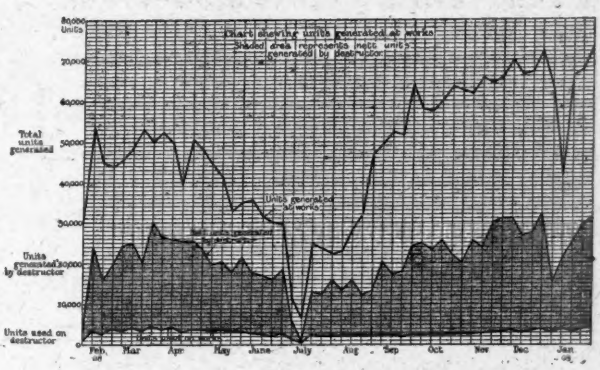


Fig. 1.—Output of Greenock Destructor, 1908-9.

boilers and pumps, 0·35d. per unit was paid to the cleansing department for steam. The accompanying chart shows the work done by the destructor during the 12 months ended January 31st last. Of the energy generated by the destructor, 12 per cent was used for power and light: 8·5 for fan draught, 1·0 for cranes, 1·4 for clinker treatment, and 1·1 for lighting; the price charged for this energy was 0·6d. per unit, on a 35 per cent. load factor. On an eight-hour test, October 29th, 1908, with a pressure of 4·6 in., burning 24·72 tons of refuse per cell per 24 hours (103 lb. per sq. ft. of grate per hour), the water evaporated per lb. of refuse was 1·41 lb. from and at 212° F.; the mean pressure was 195 lb. per sq. in., superheat 564° F., feed-water temperature 91·5° F. on entering economiser, and the electrical output 97 units per ton of refuse. The average result over a whole year's working was 67 units per ton, the highest output, including all stand-by losses on the station, that the author had met with.

The capital cost of the destructor was £19,800; labour cost 1s. 1½d. per ton for operating the destructor, and 2d. per ton for treatment of residue; other expenses brought the total to 2s. 2d. per ton. Sale of steam and clinker brought in 2s. 0½d. per ton, leaving a net balance of 1½d. The net cost of disposal was 1s. 8½d. per ton. During the year 16,995 tons of refuse were destroyed, 1,142,064 units generated from it, 5,338 tons clinker produced, and 1,286 tons sold.

Discussion.

The Chairman (Mr. W. W. Lackie), in opening the discussion said that he was of opinion that refuse destructors were dust constructors. While there might be a case made out for them for a town the size of Greenock, it was out of the question to think of utilising their wares in cities like Glasgow or Manchester, where the cleansing departments had some six or seven dust destructors The extra cost of smaller units of plant and the extra labour necessary to attend to it more than counterbalanced the saving in fuel consumption, even supposing the steam from the refuse was got for nothing. An increased use of gas and electricity for cooking and heating purposes might affect the calorific value of refuse to be obtained from residential districts. With regard to the question of charging, he thought the mechanical chain grate stoker would be an ideal arrangement. It had to be kept in mind that fuel costs were not the only thing to be considered. In most of the electricity undertakings owning dust destructors, there appeared to be an increase in the coal bill. In Greenock steam was supplied to generate about one-third of the total demand, whereas in Glasgow the dust destructors could only supply steam to generate one-tenth of the total units sold.

Prof. Baily thought this was a case where a special type of boiler seemed to be advisable.

Mr. Newington said he used to consider that dust destructors were horribly nasty smelling places. Some months ago he had

* The destructor employed is of the Horsfall type, and was fully described in our issue of May 8th last year.—Eds. E.R.

the pleasure of seeing over Mr. Robertson's works, and he found there was a marked absence of dust and smell. The arrangements for handling the refuse seemed to be very complete, and the works generally were as clean as generating stations without a destructor. He understood that the system of elevating tubs was the author's own idea. He agreed with the chairman in his remarks on the combination of electricity works and refuse destructors.

After further discussion, in the course of his reply, MR. ROBERTSON contended that in Glasgow they could have generated 18 to 20 million units for all purposes last year at their destructors. He believed chain grate stokers had been tried for burning refuse, but a great difficulty was the nature of the material dealt with, which prevented the stokers working smoothly, and another was the closing in of the grates. He was not the author of the tub-feed system, though Greenock was the first place to adopt it. The cost of collecting the refuse, carrying it out of town and tipping it was 1s. 3½d. per ton; the cost last year with the destructor was 1s. 8¾d. —an increase of 5¼d. per ton on the destructor. But against that was a considerable saving due to the centralisation of the carting system. The quality of the refuse was about one-sixth the value of coal. It had been found by experience that forced draught was most suitable for burning refuse, but he believed a combined system of forced draught and induced draught would work very well indeed. He had an idea just now for fixing such a combination at the base of the chimney for the purpose of taking pressure off the fire when the men took out the clinker, and also to assist the process of combustion.

As the following letter relates to Mr. Robertson's paper, we have thought it advisable to insert it here rather than in our "Correspondence" columns:—

There are some things I should like to discuss in the above paper: (1) capital cost; (2) sanitary grounds; (3) labour costs; (4) repairs; (5) revenue; and to compare results of the Greenock destructor plant with one recently erected at Burslem by Messrs. Heenan & Froude. Here are tabulated figures relating to both undertakings:—

	Greenock.	*Burslem.*
Capital cost of destructor, including one-half cost of site, chimney, buildings, furnaces, plant, &c.	£19,800	£4,525
Number and type of cells	Four cells tub feed	Three cells front feed
Tons of refuse destroyed per annum	16,995	7,800
Capital cost per ton burnt per 24 hours	£133	£112·5
Test.		
Duration of test	8 hours	7¼ hours
Total grate area, sq. ft. ...	80	75
Type of boiler...	2 water tube	1 water tube
Total heating surface of boilers, sq. ft.	4,140	1,966
Nature of refuse	Household and trade refuse	
Economiser	Green, 240 tubes	None
Total refuse burnt during test	32 tons 5 cwt.	11 tons 17 cwt. 1 qr.
Capacity of plant per 24 hours, tons	98·88	39·26
Total water evaporated during test, lb.	80,500	49,990
Evaporation per lb. of refuse burnt (actual), lb.	1·11	1·87
Equivalent per lb. of refuse from and at 212° F., lb. ...	1·41	2·16
Mean steam pressure ...	195 lb. superheated to 564° F.	189·5 lb., no superheat
Temperature of feed water ...	91·5° F.	45° F.
Maximum temperature of combustion chamber	—	2,300° F.
Minimum ditto	—	1,790° F.
Average ditto	—	2,032° F.
Percentage of clinker... ...	31·5	26·5

Upon sanitary grounds, admitting for the moment that mechanical handling tends to greater cleanliness, which is very questionable, in view of keeping all the boxes and spaces round them clean, it seems more sentimental than practical to object to the furnace men shovelling refuse into furnaces, when the same refuse has been collected only a short time previously by the ash men in the open street. The excessive capital costs cannot, therefore, be justified under this heading. Besides, it is generally agreed that the highest sanitation is that which benefits the greater number, and this is more likely to be obtained by the uniformly high temperatures, and therefore more perfect combustion of the gases, which is obtained with hand-fired destructors. The author admits the serious disadvantages with the method of charging, and, to my mind, the true sanitary efficiency of the plant is thereby impaired, and half-cooked gases must of necessity be emitted to the surrounding neighbourhood on the Greenock system. The temperature fluctuations on the chart (page 9) corroborate this, and it should be remarked that it is not clear that the chart records the extreme variations of temperature.

Labour Costs.—There is no saving under this heading, for the labour cost at Burslem is (average of three years) 10d. per ton. The excessive capital costs cannot, therefore, be justified under this heading.

Would the author say whether he had ever hand-fired his plant, and, if so, how did such affect the thermal efficiency?

Repairs equal £160, or 2¼d. per ton on 16,995 tons at Greenock, during first year, whilst the repairs at Burslem, for last year (the third year of working) were £27, or ·83d. per ton on 7,800 tons, so that the repairs bill at Greenock is heavy, and still one wonders is everything included in the amount given, because the contractors usually keep the plant in order for at least six months after starting up. Had the makers no maintenance responsibility?

Further, the Burslem plant is comparatively small, and has no stand-by unit, therefore higher costs might be expected.

Revenue.—To enable a proper comparison to be made, it should be pointed out that the plant at Burslem consists of three compound non-condensing sets, 100, 200 and 350-KW. capacity, therefore so good a steam consumption per unit would not be possible as at Greenock, where much larger condensing sets are in use. In spite of this, and under actual working conditions, I get, on the average, over 70 units per ton of refuse burnt.

The price of coal at Burslem is comparatively low, and so the value of the units of electricity generated from destructor steam is relatively less than at Greenock, but were my coal costs as high as the author's, and I could so afford to credit the destructor with ·35d. per unit, it follows the revenue from sale of steam would be about £800 per annum, and it should be remembered that this is got with a lower load factor and a steam consumption, due to class of plant, almost twice that of the Greenock station.

Reviewing these items, I am yet to be convinced that it is good engineering to adopt such an expensive plant.

I have not had the advantage of examining the installation at Greenock, but, being familiar with the type of plant in use, I am of opinion that the forming of large openings in the crown of the arches must result in serious constructional weaknesses.

I consider that the high water gauge, and the consequent excessive consumption of power for forced draught is unnecessary—at Burslem we find that a 2-in. water gauge is all that is required, with fires more than 18 in. thick, and that, instead of 8·5 per cent. of the units generated being used for blast purposes, as at Greenock, only from 4 to 5 per cent. is required. A higher pressure will cause "volcanoes" or holes in the fire, with impaired efficiency.

With my plant there is installed a land type Babcock & Wilcox boiler, the gases being led three times through the tubes in the usual way, afterwards passing through a tubular regenerator before being led finally to the chimney stack.

I have not found any difficulty with the dust accumulating on the heating surface, as is suggested by the author; amply deep catch pits are provided to my plant under each compartment of the boiler for the reception of dust.

I note the author's marine type boilers have 2,070 sq. ft. heating surface each, two being in use with a destructor grate area of 80 sq. ft.; my plant has only one land type boiler of 1,966 sq. ft. heating surface, and a grate area of 75 sq. ft.

The temperature of the gases leaving the boiler at Burslem being about 450°, I do not think the use of an economiser is justified, though at Greenock, the fact that the gases only once pass through the boiler makes it essential that an economiser be provided in this case. To my mind, the proper place to use the heat of the gases is in the boiler itself, and not in such an expensive and inefficient appendage as an economiser.

Air Heating.—With regard to the method of heating the air at Greenock, I consider the method crude and inefficient, as obviously any heat that is imparted to the air is but extracted from the furnace itself, and I am pleased that the author himself has noticed a further defect with the side box heating arrangement, *i.e.*, that, just at the time the air is required to be hottest, it is practically unheated.

On the regenerative system of heating as at Burslem, a temperature of 300° F. is attained, and what is far more important, this heat is obtained from the waste gases on their way to the chimney stack.

The author suggests that the disadvantage of hand firing is due to large inrushes of air above the grates when clinkering or charging. On the Burslem system, such rushes are easily controlled by regulating the dampers, and a state of pressure equilibrium is maintained between the outside and the inside of the furnace chambers.

It should be remembered that, with forced draught, the function of the chimney is only to take away the products of combustion, and in substantiation of this, I would refer you to the very slight fluctuations in the temperature of the combustion chamber shown on the test quoted.

In my opinion, there is no doubt but that a properly designed combined electric light and destructor plant can be made a financial success, and a benefit (other than sanitary) to the community, by making possible the supply of electricity for power purposes at a very cheap rate.

In the *Electrical Engineer* of April 16th last, the editor says of the Burslem station: "The station is worked very economically. The works costs, being ·54d. per unit sold, is the lowest in the kingdom for a station of similar size."

ASHTON BREMNER, M.Inst.E.E.,

Consulting and Borough Electrical Engineer.

Burslem, *May 11th*, 1909.

PARLIAMENTARY.

London United Tramways Co. Bill.

On Tuesday, last week, Lord Ludlow's Select Committee of the House of Lords commenced the consideration of this Bill. Mr. Balfour Browne, K.C., Mr. Fitzgerald, K.C. and Mr. Maccassey represented the promoters, and petitioners against the Bill were the London County Council, Middlesex County Council, and the following had reserved counsel:—Corporation of Wimbledon, Hammersmith Borough Council, and the Malden and Coombe U.D.C.

Mr. Balfour Browne, K.C., in explaining the provisions of the Bill, said that it provided for the postponement of the period at which the L.C.C. acquired certain tramways in Hammersmith, and for running powers over the L.C.C. tramways. At Tooting and Summerstown there were short gaps between the two systems and they were proposing that they should be filled up, and that the London United should have power to run cars right through to the bridges, and the Council should have the power to go over their lines. His company had 55 miles of tramways in operation, and another 19 authorised, making in all 74 miles of tramways. It had termini in the County of London at Hammersmith. Starting at Hammersmith Broadway the tramways ran West; then there was a short piece at Young's Corner to Shepherd's Bush, and another from Askew Road to the Exhibition grounds. In all there, were four small sections of about a mile each inside the London boundary Those lines were purchasable by the L.C.C. in July of this year, and if they exercised that power it would mean a serious dislocation of the traffic at Young's Corner and Askew Road. The London United Co. protested against that, as they would not be able to run right into London. As the Committee were aware, in London there were a series of through bookings between the railways and the tramways. For instance, a person could get in a car at Hampton Court, travel to Shepherd's Bush, and there go by train to the City, or any other part he was desirous of reaching. Or, again, a person could take car at Hampton Court to Kensington, and there take a train to King's Cross. Every one of the through bookings would cease if the Council exercised their powers, because there would be a break at Hammersmith. They wanted the powers postponed till 1919 and 1924. The former period for the Young's Corner line, and the latter for the tramway at Askew Road. The reason why those dates had been fixed, was because the tramway at Young's Corner which ran to Brentwood was purchasable by the Chiswick local authority in 1919, and in the second instance the local authority of Acton would be able to acquire the undertaking in 1924. Another consideration was that on those lines they had statutory stages, and fixed prices which had been sanctioned by Parliament. That would all be swept away if the lines were acquired by the Council. The existing facilities for through bookings could not be maintained. As an incident of where special legislation had been made for dealing with similar cases, he might mention the case of the Harrow Road tramways, where the Metropolitan Electric Tramways Co. worked the line for the L.C.C. Then there was the case of the tramways in Leyton, where the L.C.C. had equipped the lines, and the U.D.C. were working them. There was also a similar instance at Bexley. At all events, whether there were precedents or not, it was quite obvious that the line should be worked by one company. The great difficulty was that if the Council exercised their powers, it might even drive traffic away, for the public would have to chop and change. They wanted to provide a quick and continuous service, running as near to London as possible. Turning to the other proposal in the Bill, they were following out the recommendations of the Traffic Commission, who said that there ought to be through-running inside and outside of the County of London. They wanted the gaps at the termini of the lines to be connected up; in one instance, only 34 ft. separated them. There would not be any congestion of traffic, for the cars would run right through. It might be said that as one system was conduit and the other overhead, that there would be difficulties; but he would point out that it had been stated only recently that the L.C.C. were going to fix trolley poles to their cars. Further, his company were fixing appliances so that the cars could be run by the conduit system as well. The changing from one mode of traction to another would only take 32 seconds. It might be said that the London County Council had the most remunerative part of the system, as more people used the trams at the bridges; but he would show that the traffic on their line was exceedingly good. If it did not balance, the matter could be settled by arbitration. The Tyneside company had got powers to run over the Newcastle Corporation system. The Hammersmith local authority, although they were greatly interested in the scheme, were not opposing.

On May 12th Mr. Balfour Browne continued his address on behalf of the promoters. Dealing with the question of the company obtaining running powers over the tramways of the London County Council, he submitted that Parliament was obliged to protect the interests of the community, and not merely to protect one County Council. By their Act of 1903 the London County Council were authorised to construct a line linking up a gap in the Summerstown and Tooting line, but they had never exercised these powers, and the promoters asked that if the County Council did not exercise them within six months they should be allowed to construct the junction line.

Evidence was given by Sir Clifton Robinson, managing director of the London United Tramways Co., by Sir Wm. Bull, by Mr. H. E. Blain, tramway manager to the West Ham Corporation, by Mr. A. Baker, tramway manager at Birmingham, and by Mr. J. B. Hamilton, general manager of Leeds tramways.

Mr. H. Lloyd, K.C., addressed the Committee on behalf of the L.C.C., and other counsel for the other opposing authorities.

Mr. A. L. C. Fell, tramway manager for the L.C.C., said that the lines over which the promoters proposed to run were 17 miles of L.C.C. route and 10½ miles of their own. That was not a fair exchange. He did not think that the powers asked for were necessary. The L.C.C. already had statutory powers to enter into an agreement for through running. The London United Co. had made no offers to the L.C.C. *re* the through running. The traffic on his line was a purely businesslike one, whilst the London United depended upon holiday traffic. He questioned whether there were many people who would want to come right down to the bridges. He did not think the additional trouble of running cars outside the county would give them an adequate return. The London United carried last year 59 million passengers as compared with 412 million on the L.C.C. system. The annual average receipt per mile on the tramways was £55 and £187 respectively. The distance separating the two systems at Merton was 17 ft. to 18 ft., and the cars could be brought up almost to touch each other. The L.C.C. used the conduit system, and the Council had spent large sums of money on street widenings. The promoters were asking to share in an undertaking which had expended a large capital, but to which they were not contributing. Out of the 412,913,841 passengers carried from April 1st, 1908, to March 31st, 1909, 15,184,818 were at workmen's fares. He thought the proposals would cause congestion on the lines. Of course, if the London United put on additional cars, so in proportion would the Council's earnings be reduced. The largest part of their passengers were 1d. fares—the percentage was 45·32, and ½d. fares were equal to 24·22. They found that the percentage gradually decreased as the journeys got longer. A person would not use the tramway if the journey took over an hour, and that was where the trains could successfully compete with the tramways. If the connection was made between the two systems, he thought the traffic would be purely local at the existing termini of the undertakings.

Cross-examined: If it was the general feeling of the public to have through bookings, he did not think the L.C.C. would oppose it. The difference between the instances which had been mentioned where through bookings had worked successfully was that in London the area was very much greater. People would not travel long distances on tramways.

Mr. Shibley Benn, Chairman of the Highways Committee of the Council, next gave evidence. Mr. Pollock then addressed the Committee, and Mr. Balfour Browne replied.

In the end the chairman intimated that the Committee were unanimously of opinion that the Bill was not to proceed.

Folkestone, Sandgate and Hythe Tramways.

Mr. Stuart Samuel's Committee of the House of Commons last week considered the Bill promoted by the Folkestone, Sandgate and Hythe Tramways Co. Mr. L. Coward, K.C., Mr. H. Lloyd, K.C., and Mr. E. C. Hutchinson appeared for the promoters, and the following counsel represented the opponents:—Mr. Kem, K.C., and Mr. W. Clarke Hill, the Folkestone Corporation; Mr. Freeman, K.C., and Mr. Macassey, Lord Radnor; Mr. Balfour Browne, K.C., and Mr. Clode, the South-Eastern and Chatham and Dover Railway; Mr. Vesey Knox, the Hythe Corporation; and Mr. R. Bury for the Sandgate U.D.C.

Mr. Coward said that the promoters were asking for an extension of the powers conferred upon them in 1901 and 1906. They asked to construct the tramways in Folkestone on the conduit system, and in Sandgate and Hythe on the overhead system, and for an extension of time in which to construct the lines. A modification was also asked, of the terms of the agreement under which the Folkestone Corporation transferred their 1901 powers to the company in 1906. By the agreement it was provided that the Dolter system of electric traction would be adopted, but the system had failed, and the promoters now asked that they might be allowed to lay down the conduit system in the Sandgate and Chenton Roads, and adopt the overhead system for the other lines. As to the opposition of Folkestone, counsel remarked that it seemed to be due to a very strong "anti-tram feeling" in the Corporation. The cost of the undertaking would be only £287,500, whereas if the conduit system were to be carried right through it would be £422,000. The whole issue between Sandgate and the company was as to whether or not a ½ mile length from the Folkestone boundary should be condnit or overhead. Dealing with the objection of Hythe, Mr. Coward referred to the proposed deviation from the route of the 1906 Act.

Mr. Vesey Knox: The substantial part of the opposition of Hythe is that the Corporation consider that the company should be bound by the conditions of that Act.

Mr. Coward, continuing, remarked that in October, 1908, the Hythe Corporation passed a resolution in favour of the route. A good many years ago the South-Eastern Railway Co. took powers to construct a tramway, and to work it by mechanical traction, if necessary, but they worked it only by horses. Again, in 1900 Hythe supported a Bill for an overhead tramway through the borough, and they also supported a similar scheme in 1906. But it appeared that Hythe had been bitten by the idea that what was good for Folkestone was good for Hythe or Sandgate, and they "wanted a bit of conduit." Having dealt with this, the learned counsel proceeded to a consideration of the objection lodged by the South-

Eastern Railway Co. So far as the railway company were concerned, their objection was that the arrangements for the purchase of the horse tramways had not been carried out. The promoting company agreed to purchase the railway company's horse tramway system for £20,000. Of that £20,000, the promoters had paid £2,000, and they had agreed to pay the balance within two years of the Act of 1906, and failing payment of the balance to pay 5 per cent. upon the amount unpaid. Counsel then referred briefly to the opposition of the Earl of Radnor, and proceeded to deal with the financial part of the Bill. He said that the promoters were prepared to spend £5,000 more than the original scheme would cost. Up to the present they had actually expended £35,000, £23,000 of which had found its way into the pockets of the local authorities. Sandgate had received £3,600; Hythe, £2,000; Folkestone, £16,200 (with which they had widened streets); and the costs were £1,200. In spite of all this the authorities in question came before the Committee and endeavoured still further to squeeze the promoters.

Mr. Cownie, a director of the company, and general manager to the National Electric Construction Co., was then called. Examined by Mr. Honoratus Lloyd, K.C., witness said that he was engineer to the promoters, and he gave particulars as to the cost of the various systems. Replying to the chairman, he said that he did not believe that the Board of Trade would sanction the Dolter system, and he doubted very much if there was any chance of getting money back on the conduit system between such towns as Hythe, Sandgate and Folkestone.

Cross-examined by Mr. R. Bury, Witness denied that, when the schemes were brought forward, it was practically a question of their being put up to auction. He estimated the difference in the cost of putting in the conduit and the overhead system from the Folkestone boundary to the Coastguard Station at £11,000.

In reply to Mr. Ram, K.C., Witness said that the sum of £1,200 paid to Folkestone was the cost of Folkestone's provisional order, which the company took over. The £16,000 was spent on road widening.

On Wednesday, Mr. Ram, in resuming his cross-examination of Mr. Cownie, referred to the Lorain system. Witness said he objected to the use of the system at Folkestone because the patentee would give no guarantee.

Mr. Ram put in a communication dated May 3rd from the town clerk of Wolverhampton to the town clerk of Folkestone, in which it was stated that the Lorain system was working satisfactorily. Continuing, Witness said that if the requirements of the Folkestone Corporation were carried out, it would cost over £50,000 more than the promoters' proposals. Constructed on the conduit system, the lines in Folkestone alone would cost £165,642, as against £108,388 under the proposals of the present Bill.

Answering Mr. Freeman (for Lord Radnor), Mr. Cownie admitted that the company had paid no dividend last year, but he considered that it was in a very strong financial position—quite as strong as it was in 1906, when it paid 7 per cent.

Mr. Vesey Knox then cross-examined witness on behalf of Hythe. He agreed that the stipulation of the company with the Hythe Corporation was for an underground system.

Mr. Frank E. Stanley, electrical engineer to the National Electric Construction Co., was then called. He considered that it would be impossible to work the conduit system along the sea front at Seabrook and Hythe, owing to the liability of flooding by the sea. The extension of time asked for was two years.

In cross-examination by Mr. Freeman, Witness admitted that he had been an advocate of the Dolter system, which everybody thought was going to be a success, but which had not realised expectations.

Mr. Walter Hopkins, of Messrs. Geo. Hopkins & Sons, was then called, and said that the scheme presented no engineering difficulties. The sharpest gradient was only 1 in 51. In his opinion the districts included in the scheme could not carry the expense of a conduit system throughout. He was certain that no financier would support such an idea.

By Mr. Ram: He estimated that the gross revenue, if the 1906 scheme were carried out as the Corporation desired, would be £37,500, and the net revenue £14,584.

On Thursday Mr. Richard Bacon, town clerk of Oxford, was called. He said, in reply to Mr. Hutchinson, that the Corporation of Oxford in their agreement with the National Electric Construction Co., had a very similar clause as to the provision of an underground system. His Corporation made inspections of the Dolter system at Mexborough and Hastings, and also inspected the various other surface contact systems at Lincoln, Wolverhampton, &c. At Wolverhampton they saw the Lorain system, and from their observation and expert advice they decided not to adopt it. The total length of the Oxford tramway system was 14 miles, and of this three miles were to be conduit, and the remainder overhead. Under the 1907 Bill the National Electric Construction Co. were to pay Oxford £1,000 a year rent for three years; £1,300 a year for three years, and £1,500 for the remainder of the 42 years, but as a result of the difficulty which had arisen over the Dolter system a compromise had been effected, and the company were to pay only £1,000 per year for the 42 years.

The Mayor of Hythe (Mr. J. Bennett Tunbridge) was then called. He said that this year's opposition on the part of Hythe amounted to only two questions, the change of route and the change of systems. The first question had been decided; it only remained for the question of system to be settled, and he advocated the overhead system.

A number of local witnesses were then called.

On Friday Mr. Balfour Browne (for the S.E. and C. Railway Co.) informed the Committee that he thought there was a possibility of an agreement being come to with regard to the purchase money of the existing tramway. He asked, therefore, that consideration of that matter should be adjourned for an hour or so.

The Committee agreed to this course, and Mr. Stephen Sellon was then called. Referring to the Lorain system, he said that it was introduced at Wolverhampton as the result of a dispute between the Corporation and the British Electric Traction Co., the Corporation wishing to "keep out" that company from the place. Witness went on to say that he thought it would be impossible to work the Lorain system and the conduit together. He considered the overhead system was the best for the district, and he had actually obtained the consent of Sandgate and Hythe for such systems, although he had never been able to obtain the consent of Folkestone to it. He considered the offer of the conduit system for Folkestone was a very generous one.

Mr. Ram, in opening the case for the Folkestone Corporation, said that Folkestone never had wanted tramways, and did not want them now. The Corporation obtained a provisional order to protect themselves as far as possible by either carrying out the powers themselves or imposing stringent terms on any others who sought to do so. It was in that spirit that the Corporation entered into the agreement with the company in 1906, and that they asked Parliament to say that the company should abide by it. The Corporation would accept the conduit system throughout, but the company wanted some overhead wires, and this the Corporation strongly objected to. The Lorain system was a workable system, and cost about the same as the overhead system.

Mr. C. E. C. Shawfield, electrical engineer for the Wolverhampton Corporation, was called, and said it was under his advice that the Wolverhampton Corporation accepted the Lorain system. They had 20 miles of track, and were proposing to construct three more miles. The cost of the system came out at about £8,500 per mile. Inter-running was going on between the Lorain and the overhead systems without any difficulty. For the year ending March last the net balance, after payment of working expenses, was £6,762, of which £4,416 was allocated to the renewal fund, the balance being carried forward.

In cross-examination by Mr. Lloyd, the Witness said he was not prepared to give the name of any engineer who agreed with him as to the Lorain system, and he knew of no other place where it was in operation. He admitted that brine was a very damaging agent to surface contact systems, and he would not recommend any surface contact system to be put down in a place which was swept by the sea.

(To be continued.)

Electric Light Provisional Order Bill No. 1.

On Monday the Examiner found that Standing Orders had been complied with in the case of this Bill, which confirms Board of Trade Orders under the Electric Lighting Acts in regard to the following:—

1. To the Chesham Electric Light and Power Co. in respect of the extension of their existing area of supply to include the urban district of Great Berkhampstead and parts of the rural district of Great Berkhampstead and Amersham. Clauses are inserted under which the U.D.C. of Great Berkhampstead may require the undertakers to sell to them so much of the undertaking as may be within their area at the expiration of 10 years, subject to one year's notice, and also to enter into an agreement to furnish them with a supply of electricity in bulk for 30 years. Similar powers are given to the Great Berkhampstead R.D.C.
2. For the amendment of the order of 1900 of the U.D.C. of Cleethorpes, extending the time for the completion of works, &c.
3. Order to the Herne Bay U.D.C.
4. To enable the Hindhead and District Electric Light Co. to extend their area so as to include portions of the rural districts of Farnham, Hambledon, Alton, Petersfield and Midhurst.
5. Order to Christy Bros. & Co., of Chelmsford, in respect of the district of Holsworthy, in Devon. The powers under the Order are not to be exercised unless the undertaking is transferred to a registered company. The local authority will have power to purchase within 25 years.
6. To enable the Southampton Corporation to supply the districts of South Stoneham and North Stoneham. Power is reserved for the local authority to purchase the undertakingwithin its area.
7. Order granted to the Egham Electric Light Syndicate in respect of the urban district of Staines, such order not to be exercised unless transferred to a registered company.
8. Order granted to the U.D.C. of Stourbridge.
9. Order granted to the U.D.C. of Turton.
10. Order granted to the Coast Development Syndicate, Ltd., in respect of Walton-on-the-Naze. Power was reserved for the Urban District Council to purchase within 12 months of the commencement of the order.

London County Council Tramways Bill.

Sir G. Doughty's Select Committee of the House of Commons commenced the consideration of this Bill on Thursday, May 13th.

Mr. Erskine Pollock, K.C., who, with Mr. Roskill, K.C., and Mr. Lynden Macassey, appeared for the promoters, said that the objects of the Bill were the reconstruction and extension of various lines of tramways. In some cases it would be necessary to widen certain streets and in others to reconstruct bridges. Coming to a consideration of the particular proposals, Mr. Pollock dealt first with the proposed extension of the Council's tramways in the Farringdon Road. The intention, he explained, was to bring the existing lines to the boundary of the City of London at Charterhouse Street. That extension would be only a quarter of a mile in length, but it would, without doubt, be a great convenience to the vast travelling public. In this connection, counsel pointed out that on the 129½ miles of tramways now owned and worked by the Council, they had carried during the past year 412 million passengers. The extension of the Farringdon Road line would be on the conduit

system, and was estimated to cost £12,000 for the double track. Besides this, and in order to make the tramways complete, it was proposed to spend a further £3,000 on making a junction with the tramways in the Clerkenwell Road. This would necessitate the widening of the railway bridge at that point, and against that the Great Northern Railway Co. had petitioned. He (counsel) considered, however, that the proposal could not in any way do injury to the railway company. Counsel, having referred also to the opposition from the Clerkenwell Street Sellers' Union, representing some 700 costermongers, then proceeded to explain other proposals in the Bill, which included a double line 1 mile in length, connecting Chelsea with Battersea, passing over Battersea Bridge; a connecting route between Mitcham and Streatham; the lengthening of the Tooley Street line, and the construction of a new connection of the line in Evelyn Street, Deptford, with the line in Church Street, Greenwich. Counsel also dealt briefly with the tramway on Highgate Hill, which he said would be reconstructed should the purchase be carried out as intended.

A considerable mass of evidence was given with respect to the coster trading in Farringdon Road.

Mr. Shirley Benn (the Chairman of the Highways Committee of the L.C.C.), who spoke as to the desirability of the Farringdon Road tramway, admitted in cross-examination that in 1899 and 1901 the County Council applied for powers to run a tramway down Farringdon Road, but were refused. He considered, however, that the circumstances now were entirely different and justified the construction of the line. Answering the Chairman, he said he believed the Council had no power to compensate the traders in respect of any action they might take.

Mr. A. L. C. Fell, tramways manager for the L.C.C., said the Farringdon Road line would have a great effect on the whole tramway system. He estimated that the annual receipts from that line would be £7,300, and the working expenses £4,258, and that after providing for other charges there would be a profit of £1,028.

Practically the whole of Monday was occupied with evidence regarding the proposed removal of Farringdon Road costermongers, and on behalf of the G.N. Railway. On Tuesday the Chairman said that the Committee felt that the extension would be of public service, and if a reasonable assurance could be given, and a clause inserted undertaking that the trams should be worked without causing obstruction to the G.N. Railway, they would allow the tramway. Mr. Pollock promised to bring up a clause, and the Farringdon Road extension was approved. The Committee proceeded to deal with the proposed tramways from Battersea Park to Chelsea.

(To be continued.)

Electric Lighting Provisional Order (No. 2) Bill.—This Bill, which confirms the provisional order granted to the local authority of Dunfermline, was on Monday passed by the Examiner. Power is given to the Council to transfer the order to the Fife Electric Power Co.

Tramway Orders Confirmation Bill (No. 1).—On Monday the Examiner found that the Standing Orders had been complied with in the case of the above Bill, which will enable the following works to be carried out:—

To authorise the	Bolton Corporation	to construct about		8 miles	of tramways.
,, ,,	Keighley Corporation	,,	,,	1 mile	,,
,, ,,	Morecambe Corporation	,,	,,	2 miles	,,
,, ,,	Portsmouth Corporation	,,	,,	1 mile	,,
,, ,,	Whitworth U.D.C.	,,	,,	3½ miles	,,

North-West London Railway Bill.—Further evidence was given and counsels' speeches were delivered last week, beyond the report given in our last issue, and it was then announced by the chairman that the Committee unanimously found the preamble not proved.

Baker Street and Waterloo Railway Bill.—It is announced that the above Bill has been withdrawn. Under the Bill powers were sought to extend the time for the completion of the works authorised by the Act of 1906, &c.

LEGAL.

The Consolidated Nickel, Tin and Copper Mines, Ltd., *v.* Crompton & Co., Ltd.

(Continued from page 797.)

The hearing of this case was continued before Mr. Muir Mackenzie, the Official Referee, in the High Court of Justice during last week.

Mr. Abel Thomas opened the case for the defence. Broadly speaking, he said, his clients' case was that the plant supplied was in accordance with the specification. The trouble experienced was always put down by the plaintiffs to the machinery itself, and not to the way in which the plant was worked. His submittance was not that the machinery was over-loaded or that it was too weak for the purpose, but that it was worked by people who were utterly ignorant of gas engines and electrical plant. The contract had been acted upon by the plaintiffs as though it were a contract by which defendants had guaranteed that they would work the machinery for months with their own men. In reality it was nothing of the kind. If they had liked they could have sent Mr. Cragg away on September 7th, 1907, when the machinery had been set to work, but Messrs. Crompton had a custom of leaving a man in charge when they sent machinery down to distant places, not because they were obliged to do so, but because they desired their machinery to run properly. It was in this way that Cragg was left at the mine, and this was the secret of the whole mess they and the plaintiffs had got into in the case. All they guaranteed with regard to the electric generator was that it should be capable of producing a normal output of 55 kw., at 550 volts, 50 cycles, when running at a speed of 750 r.p.m. Nobody had denied that it did do that. The motor supplied to plaintiffs was like hundreds of other motors sent out by defendants, which were tested, and were capable of doing the work which they were specified to do. The exciter was ample for the purpose if used properly. The specification said the pump would be "capable of delivering 1,000 gallons of water per minute, against a total head of 120 ft., including friction." This was to be coupled to their standard "three-phase induction motor of 55 b.h.p., running at a speed of 1,450 r.p.m. on a 550-volt, 50-cycle circuit." His clients submitted that the meaning of the specification was that they had to supply a pump capable of raising water where there was no friction 120 ft. high. That was what they asked Worthington's to give them. The whole of Mr. Rosenbusch's evidence was based upon the assumption that defendants were supplying a pump which would raise water ideally to a height of 130 ft. In a letter written to Williamson by the defendants on February 28th, 1907, they stated that the pump motor would be forwarded to the pump builder's works, where a complete sinking pump would be erected. It would then be tested to see that everything was satisfactory, and they estimated that the complete pump would be delivered on the site in about 12 weeks from that date. That, continued counsel, defendants never did. Mr. Williamson succeeded in frightening them so much, that they were afraid not to deliver as soon as possible. The time passed for delivery, and they did not wait to test the pump with the motor complete, in accordance with practice, but sent them separately and put them together at the mine. That, unfortunately, was the beginning of the way in which the minds of the gentlemen who were working for Messrs. Crompton were misled, because they knew there ought to have been this test, and they were afraid, when things went wrong, that perhaps it was the fault of their machinery. The result was that they never saw what was really happening, viz., that unskilled men were trying to work a thing which really required skill, and they were always trying to do something to the motor. Unskilled workmen allowed an excess of electric power to run into the motor at a time when irregularity created by bad gas in the suction plant had put the generator out of step with the motor. Immediately that happened, unless the pump were switched off, the result would be to burn out either the stator or the rotor. And this happened three times. On each occasion Mr. Cragg was nowhere near the mine, and the plant was in the hands of infants at the work. As to the question of the air-gap, it was an astonishing story that, with a suspended motor such as this, with two bearings 29½ in. apart—he was taking Mr. Rosenbusch's figures—the shaft could be moved over even the small space there was between the rotor and the stator. It would be very difficult for it to do it, but it had done it, and there was only one way of accounting for it, viz., by burning some of the bars either of the stator or the rotor. His clients, after long consideration, had come to the conclusion that they had now re-installed that motor in practically the same condition it was in when it was put up, and that it was working at the present time perfectly and well, because the people who were now working the gas engine and the motor itself knew their business, and were running the plant properly. Mr. Thomas then called the first witness for the defence.

Mr. Richard B. H. Cragg said that on June 3rd, 1907, he went down to take charge of the plant at the Wheal Busy Mine for Messrs. Crompton. He saw there three of "Captain" Tomkin's men, who were ultimately made engine-drivers. None of them seemed to know anything about electricity. The Worthington pump arrived on July 23rd, and after delay over a foot valve and strainer, the first attempt to start it was made on August 19th, but the pump would not start. The stator was taken away and the air-gap increased by $\frac{1}{100}$ in. On August 31st they got to work, but at the end of a week the thrust bearing of the pump heated, and Messrs. Worthington's representative came down. The installation was again started. Witness reported to his firm that at week-ends they had trouble in getting the plant to start, as the producer was cleaned out on Saturdays, and the gas was generally bad for some time afterwards. On September 13th the main bearing of the motor seized whilst he was away. He found that the main shaft had seized and was sticking to the sleeve in the thrust bearing. On the 17th, the motor broke down again, the stator was burned out in two places, and the bars of the rotor had gone. He was not present when it happened. At the time this burn-out occurred, the plant was in the hands of the plaintiff's men. The motor was sent away to Chelmsford, returning again on September 30th. By that time the water was back to the adit level.

At this juncture, counsel put in a letter from Mr. Williamson to Mr. Norbert, dated September 30th, 1907, in which was the following remark: "You ask in your letter if we have got a proper efficient engineer in charge of the plant. I should say decidedly not, but should think such a man is procurable, and should be very pleased to look one up for you."

On October 4th, said Witness, Mr. Miller came down, and from October 9th to November 13th, the motor ran without any serious stoppage. In reporting to defendants, witness wrote that he

thought all his time since October 14th ought to be charged to the Consolidated Company, as, with the exception of the burning of the leads on October 17th, nothing had been wrong with the plant, which could fairly be ascribed to the defendant company. "While I am writing on the subject," witness continued in his report, "I must say that unless they get a good man to look after this job they will continue to have trouble, as the men do not know their work, and apparently do not intend to endeavour to make themselves competent. There is, unfortunately, a strong prejudice against gas engines, and if there is any trouble their tendency is to sit down and send for somebody to put it right. They are used to Cornish pumps, which want little or no attention, and resent having to look after things." On November 13th there was another breakdown, but again witness was not present when it happened. He denied that on this occasion, when he was leaving the mine to go to Truro, Martin reported to him that the temperature of the motor was high, and that he laughed at the suggestion. They told him that the temperature of the motor had run up to 220. It was restarted about 7 o'clock, but at 10 o'clock they sent for him saying a fuse had gone. He had the motor up to the surface and found that there was a burn-out in the stator, and there was no solder in the rotor. Both stator and rotor were re-wound. Between December 7th and 20th the motor was up again out of the mine because it had developed a "knock," which was found to be due to the top ball race, and it was during this interval that the ball races were being altered. The motor was installed on Saturday, the 20th, and after some trouble, owing to bad gas for the engine, they started the plant running again at about 9.30 a.m. In the early hours of Sunday morning the earth lamps showed an earth, indicating a defect in one of the windings, and the whole plant was once more shut down. Examination of the motor showed that the solder had again been melted out of the rotor, and witness sent it back to Chelmsford. He was not present when the breakdown occurred. During the first week in March, when the motor again came out of the repairing shops, the plant started running again.

Counsel: And has it run satisfactorily since?—We have had some trouble with belt fittings.

Cross-examined by Mr. Russell, K.C.: Witness said it was true he wrote to his people on August 23rd, suggesting that they should examine the spindle of the motor, and ascertain whether it was deflected, but that was not the idea upon which he acted later. The instructions to increase the clearance came down from the works. Witness also admitted a letter which was written by Mr. Sexton, another of defendants' engineers, who was by this time on the scene, which stated: "It seems that the motor was designed for an air-gap of ·04 in. all round, but we find that it measured only ·03 in. Also I note from the works' letter that it can be increased 50 per cent. without injury." After that, witness himself wrote stating that the air-gap had been increased from ·03 to ·05.

Counsel: You hoped by these alterations to overcome the jamming of the rotor against the stator?—Yes.

Witness was then cross-examined at considerable length as to his position at the mine, duties, &c. With regard to the breakdown of September 13th, Witness said it was quite true that at that time he did think the cause of the trouble was the fact that it was a totally enclosed motor, and in his report suggested that the temperature rise was due to insufficient ventilation. Witness did not agree with the view that the method of starting up had alone been responsible for the trouble, because 10-h.p. induction motors were very often switched direct on.

Counsel: On September 17th you report that "the motor itself gets extremely hot after it has been running three or four hours; I cannot bear my hand on it anywhere." That was a very improper condition for the motor, was it not?—Witness admitted that it ought not to have got so hot as that. They were pumping at that time at a depth of about 30 ft. The motor was not pumping against anything like a full head. At the time referred to in his report, the motor was taking about 58 to 62 amperes. It was true his firm sent an auto-transformer down with the view of making the plant start better, but it did not prove so efficient a way of starting up as the one already in use.

Further cross-examined by Mr. Russell regarding the terminals being burnt out, Witness said that the terminal wires had been covered with cotton, and after the mishap they substituted vulcanised rubber cables. In the letter of October 17th it was stated that the trouble was "due to wood bushes (which protect the leads) having been carbonised and causing a short-circuit." He was not surprised at the mishap, because it had already been pointed out that the arrangement for bringing the leads out of the motor was not at all satisfactory. On October 29th, 1907, it was not a fact that the vaporiser was leaking, but the overflow pipe was filled up. When that was afterwards cleared out, the difficulty disappeared. The cause of the stoppage was a piece of coke floating in the vaporiser, which occasionally came in front of the overflow pipe.

Further cross-examined, Witness said he found evidence that all the coils had been affected by overheating, because the cotton insulation was charred.

Witness was cross-examined at great length upon the correspondence, and admitted that at one time they had not got a starting switch for the motor, but he said that it would not start at all with a proper starting switch and auto-transformer.

(To be continued.)

Aluminium Corporation, Ltd.

In the Companies Winding-up Court on 18th inst., Mr. Justice Neville sanctioned a scheme of arrangement, on the petition of the company and the liquidators.

Gould *v.* Lehwess.

In the King's Bench Division on Tuesday, Mr. Justice Phillimore heard this case, in which Mr. Chas. A. Gould, of 341, Fifth Avenue, New York, was the plaintiff, and Mr. Edward Ernst Lehwess, of Whitehall House, Charing Cross, was the defendant.

Mr. J. R. Atkin, K.C., and Mr. Douglas C. Bartley appeared for the plaintiff, and Mr. Gore Browne, K.C., and Mr. David White were for the defendant.

Mr. J. R. Atkin, opening the case for the plaintiff, said the claim was for £3,200, the price of certain electrical batteries provided by the plaintiff. The plaintiff was the inventor of an electric accumulator battery known as the Gould battery, which was largely used for the purposes of electric traction in America. The great difficulty of providing for certain kinds of electric traction, said counsel, was the storage of the electricity. The accumulator invented by Mr. Gould had largely overcome the difficulty, and it was in wide use in America, where it was controlled by a company with a large capital. The American rights were transferred to that company, of which Mr. Gould was the president. He retained, however, his property in the British European rights. In 1906, a company called the Electrobus Co. was formed in this country, and the defendant was, apparently, largely interested in it. In the same year, Mr. Lehwess went over to America to see Mr. Gould for the purpose of securing the English rights on behalf of the Electrobus Co. He had a series of interviews with Mr. Gould, and suggested that a company should be formed in England for the purpose of selling and manufacturing these batteries in London and for negotiating with the Electrobus Co. for the use of them. Mr. Gould refused to have anything to do with such a company unless it guaranteed a cash capital of at least £25,000. Defendant said there would be no difficulty about that. The price of the English rights to the patent was fixed at 60,000 dollars, and Mr. Lehwess made it clear that he wished Mr. Gould's interest to be in shares in the company. That was agreed to, and it was further arranged that Mr. Gould should have the control of the company, and should have 55 per cent. of the shares allotted to him fully paid up. In pursuance of this arrangement Mr. Lehwess deposited the sum of 10,000 dollars in a New York bank as a guarantee that he would carry out the arrangement entered on. On November 1st, 1906, it was agreed that the defendant should form a company in England, to be called the Gould Storage Battery Co., for the purpose of introducing the Gould battery into England. Plaintiff, on November 30th, 1906, cabled defendant, "Do I understand that £25,000 in cash has been paid?" to which defendant replied, "All shares issued cash. About 4,000 reserved." Relying upon that representation plaintiff sent over 15 sets of batteries of 42 cells each, which were supposed to be paid for by the company at the price of 860 dollars per set. A further set was sent later. There was a stipulation that a list should be made of the batteries in London, and an expert of Mr. Gould's works was sent over to give a demonstration in the presence of an independent engineer. The batteries, said plaintiff, passed all the tests stipulated for in the agreement. Defendant contended that in accordance with his agreement with plaintiff he formed the Gould Storage Battery Co., of England, with a nominal capital of £25,000. In accordance with the agreement, plaintiff received 55 per cent. of the share capital. He denied that he was personally liable for the amount of the contract, which he said was due by the company, if by anybody.

Mr. Atkin further stated that his client relied upon the shares of the company in England being equivalent to £25,000 in cash. Instead of that, the whole of the shares that were issued were issued to the Asiatic Banking Corporation, of the Channel Islands. This company paid nothing for its shares, but Mr. Gould remained under the impression that it had done so. Plaintiff alleged that by conducting tests, &c., of the batteries in question and other methods defendant made it impossible for him to carry out his agreement, and, therefore, he was entitled to judgment.

Mr. Chas. A. Gould, in the witness-box, stated that he was the inventor of the cell in question, and the plaintiff, and was still owner of the English and European rights. These batteries were in great use in America for electric traction work, for electric lighting in railway cars, and for submarine and other purposes.

Evidence was given to bear out counsel's statement and describe the way in which the tests were interrupted.

(To be continued.)

Postmaster-General *v.* The National Telephone Co.

Mr. Casserley applied to Mr. Justice Neville in the Chancery Division on Friday last, that a decision of the House of Lords might be made an order of the Court. He stated that the action was tried by Mr. Justice Swinfen Eady in the first instance, and his decision was reversed by the Court of Appeal. The House of Lords reversed the decision of the Court of Appeal, and he now asked that the order of the House of Lords might be made an order of the Court.

There was no opposition, and his Lordship made the order accordingly.

Wireless Telegraphy.—It is reported that communication has been established by wireless between Viborg, in Finland, St. Petersburg, and Sebastopol in the Crimea, the distance in the latter case being 1,000 miles.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Electric and Ordnance" Fans.

The Electric and Ordnance Accessories Co., Ltd., of Aston, has recently issued a comprehensive fan catalogue for the coming season, which illustrates and describes a variety of patterns of this useful device.

We illustrate, in fig. 1 the A.P. Universal type of ventilating fan, which has been supplied largely to the British Admiralty, and

Fig. 1.—The "A.P." Universal Type Fan.

which is constructed for d.c. circuits with pressures of 60 to 250 volts. The fan and motor are arranged on a universal swivel, and the base can be fixed in any convenient position without interfering with the utility of the fan; a combined starting switch and speed regulator is fitted in the base.

We also illustrate a cabin ceiling fan, fig. 2, designed for use under low ceilings, and fitted with two aluminium blades. These, of course, are only two designs of many; the catalogue shows a.c.

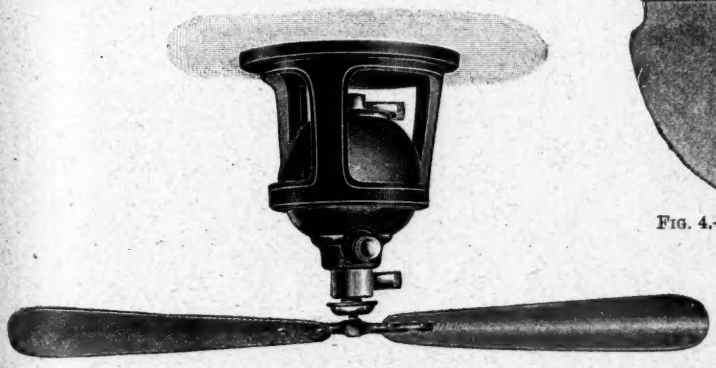


Fig. 2.—Cabin Ceiling Fan.

desk fans, d.c. railway saloon fans, porthole fans, and ceiling fans of various types.

The 12-in. a.c. desk fans are fitted with small squirrel-cage motors arranged for voltages of 100-250, and periodicities of 40-70. The fans are substantially made, and are British products throughout.

Portable Safety Lamp.

The British Central Electrical Co., of 17, Hatton Garden, E.C., have sent us a sample of their new patent portable hand lamp, which has been designed with a view to securing the utmost possible degree of safety, in accordance with the requirements of the Home Office. The stock, or handle, consists entirely of wood, which completely encloses the lampholder and flexible; the device is supplied with a key-switch if desired, and this also is completely enclosed, and has a handle of insulating material. The cage consists of stout tinned steel wires, secured to a ring, which is attached to a brass plate with fly-nuts. The screws fixing the brass plate to the wood stock are, in the latest pattern, driven axially, not radially, so that a long screw cannot possibly be driven into contact with the lampholder, and the leather strap at the end of the handle is secured in place with binding wire, so there are no radial screws at all. It would seem impossible to make contact with any part of the device that could by any chance become alive; and we understand that in view of this fact, the Home Office is willing to allow this hand lamp to be used without the earthing wire that would otherwise be required.

New Armorduct Devices.

Several new ideas are being put on the market by the Armorduct Manufacturing Co., Ltd., of Farringdon Avenue, E.C., some of which are illustrated here. Observing that a group of "Gral" or other metallic-filament lamps giving 500 c.p., consumes only about as much power as an arc lamp—less than an enclosed arc—and gives equal illumination, the company has had the happy idea of devising the "Gral-arc" fittings (figs. 4 and 5) to take the place of arc lamps, with the advantages of low first cost, better diffusion of light, greater safety from fire, and freedom from fumes

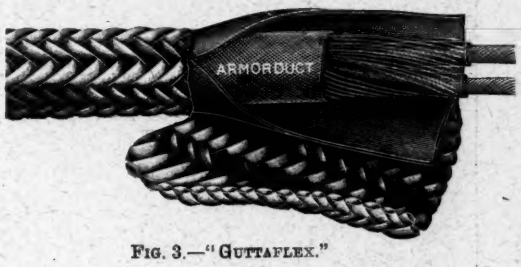


Fig. 3.—"Guttaflex."

and flickering, while trimming is reduced to a negligible quantity. The long art-metal bodies, which are suitable for indoor and outdoor lighting, are provided merely for the sake of obtaining an artistic and pleasing appearance; for rooms with low ceilings, shorter but necessarily less graceful patterns are made.

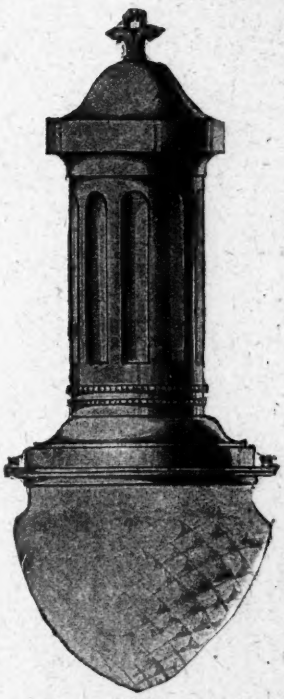


Fig. 4.—"Whitehall" Fitting.

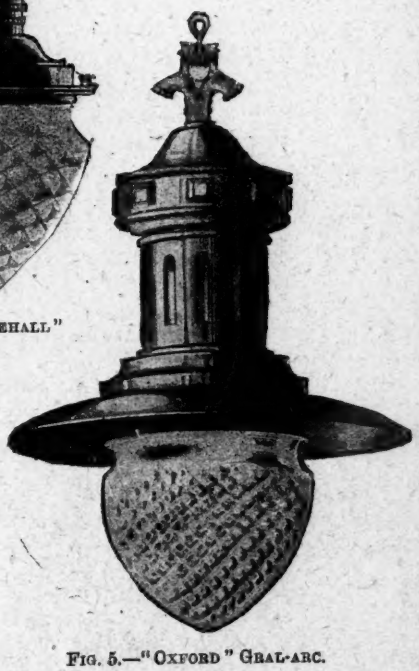


Fig. 5.—"Oxford" Gral-arc.

Another novelty is a lampholder "husk"—a neat ornamental cover for the rather clumsy looking large brass caps of metallic-filament lamps, in various finishes. When this is used with frosted lamps for general lighting, shades can be dispensed with.

Finally, fig. 3 shows a new rubber-braided flexible cable called "guttaflex"—a cable consisting of two flexible conductors insulated with pure and vulcanised rubber, laid up to circular form with jute fibre, covered with rubber-proofed tape and sheathed with vulcanised rubber. Over this sheath is laid rubber-cord braid, and the whole is vulcanised. The rubber cord consists of a whip-cord core completely covered with a thick layer of rubber. The cable is extremely flexible, and its resilient rubber sheathing renders it strongly resistant to abrasion or other mechanical damage through rough handling, while its exceptional protection with insulating material affords safety from shock to the user. It is also of pleasing external appearance, and should prove a useful line.

E

Domestic Circuit-Breakers.

Although the average domestic electrical installation does not suffer to any appreciable extent from the blowing of fuses, yet there are doubtless cases where a certain amount of inconvenience is caused by the delay while the local wireman is replacing a blown fuse. For those who would avoid trouble of this sort, Messrs. Spagnoletti, of Goldhawk Road, W., have introduced an automatic cut-out board which replaces the ordinary fuseboard.

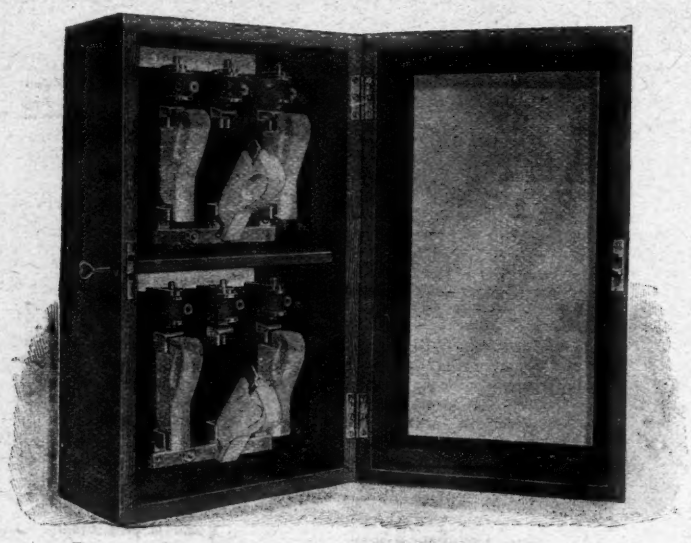


Fig. 6.—"Easy Replacement" Automatic Cut-Out Board

A comparatively inexpensive minature circuit-breaker is fitted in each pole, and can, of course, be easily closed under ordinary conditions, but which offers a special safeguard in case of a permanent short-circuit, as the closing of the breaker on one pole immediately opens the breaker on the other.

The porcelain carriers of each switch contain a master fuse, which will safeguard the circuit if the cut-out fails; to save the trouble of opening the board in a special pattern, small levers are fitted in the cover, which enable the cut-outs to be replaced from outside. Fig. 6 gives a good idea of a three-way distribution board on this system.

Veritys' Fans.

Electric fans made in England form a special line that is being pushed by Messrs. Veritys, Ltd., just now for the current season. Attention may be more particularly drawn to the "Delhi" alternating-current desk fan, as this is the first year in which the firm have placed on the market A.C. fans of their own manufacture. The "Delhi" desk fan, as shown in fig. 7, has a self-starting induction motor, and no fibre whatever is used in its construction. The bearings of the fan, and also those in the case of the new "Typhoon" desk fan for direct current, are composed of solid cast-

Fig. 7.—The "Delhi" A.C. Desk Fan.

iron, in which the spindle runs. These bearings are of ample length, and by dispensing with the usual gun-metal liners perfect alignment can be ensured. The "Delhi" fans are treated of in the firm's Leaflet No. 603 just issued. Their "Typhoon" fans mentioned above, are covered in Leaflet No. 602. In these, by means of a neat arrangement, the fan and trunnion can be taken out of the pedestal stand and placed in another socket provided on the pedestal, whereby the desk fan is metamorphosised into a bracket fan, as it appears in fig. 8. Messrs. Veritys' "Aston" ventilating fans of from 12 to 60 in., are well known to the trade; they are provided with ball-thrust bearings and grease lubrication, and are, therefore, suitable for either vertical or horizontal discharge.

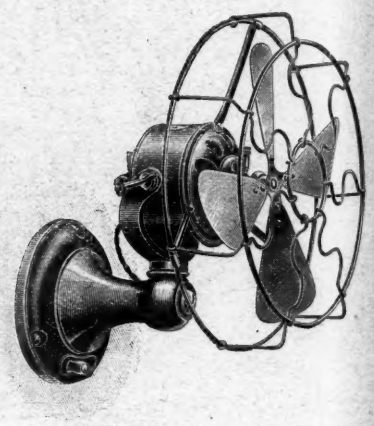


Fig. 8.—The "Typhoon" D.C. Desk Fan.

BUSINESS NOTES.

Bankruptcy Proceedings.—*Re* C. H. W. Biggs.—This debtor attended before Mr. Registrar Giffard at the London Bankruptcy Court on Wednesday, May 12th, for public examination upon accounts showing total liabilities £10,418 (unsecured £9,271), and net assets valued at £3,407, after deducting £589 for payment of the preferential claims. The receiving order was made on a creditor's petition, and at the first meeting of creditors Mr. G. M. White, chartered accountant, and Mr. A. R. King Farlow, chartered accountant, were appointed joint trustees to administer the estate in bankruptcy, assisted by a committee of inspection.

Replying to Mr. E. Leadam Hough, senior Official Receiver, the debtor stated that since 1884 he had carried on business as a printer and publisher; his premises during the past 20 years had been at 139-40, Salisbury Court, Fleet Street. The trading style since the end of 1906 had been Biggs & Sons, but his two sons merely worked in the business at a weekly salary, and had no further interest whatever in the concern. It was the fact that a private meeting of the creditors had been called upon the instructions of his eldest son, and that an appearance to a writ had been entered by his sons and himself. The latter step was due to inadvertence pure and simple, and the meeting was called while witness was away from business by reason of illness. The banking account had throughout been in the name of Biggs & Debenham; witness had never admitted his sons into partnership, nor had he ever held them out to creditors as partners, whilst the tenancy of the premises had always been in his own name. From 1879 to June, 1908, witness was a director of the *Contract Journal* Co., Ltd., which owned the *Contract Journal*, a constructional engineering paper. He acted as editor at a salary of £500 a year until last September, the duties including the printing and publication of the paper. Owing to disputes, he resigned his directorship in the early part of 1908, and the printing contract was taken away in September. Since 1884 he had also published the *Electrical Engineer*. That was not exactly his own property, because the capital had been advanced by another person. There had never been any trouble in connection with that publication. In October, 1908, witness commenced a paper styled *Biggs & Sons' Contract Record and Municipal Engineer*, and its appearance led to an action being brought against him by the *Contract Journal* Co. Very soon after the start, witness sold the paper to his daughter-in-law, Mrs. Rose Biggs, for £500, which was paid by £250 in cash, and £250 in shares placed in the names of his two sons. The consideration given to the lady for the £500 was the name of the paper and book debts that realised £113, and it was further agreed that witness would print and publish the paper in return for one-half of the net profits. Mrs. Rose Biggs sold the paper to the Salisbury Publications, Ltd., and witness had printed and published the paper up to the present time, but no net profits had been earned. He attributed his failure to his liability for money advanced and interest claimed by the trustees of the estate of his late partner's father. In 1888 he was joined for a short time by Mr. Eric Debenham as a partner, and a sum of £2,000 was provided by that gentleman's father as capital for the purpose of developing the business. After the death of Mr. Debenham, sen., about three years ago,

the trustees of the estate pressed for repayment of the £2,000 and interest, and being at the time greatly troubled in mind through his wife's illness, witness signed an undertaking to repay the amount by instalments. He now, and had always, considered that there was no claim against him, the money having been advanced for the purposes of, and lost in, the business. Balance-sheets were prepared annually, but they only disclosed a summary of the year's receipts and payments for income-tax purposes, and did not show the financial position. The drawings for household and personal expenses up to a year ago had been at the rate of £1,000 per annum, and had been well inside the income due to witness.

Asked further regarding the action brought by the *Contract Journal* Co., Ltd., the debtor said the company objected to the title proposed for his new paper, and they also wanted an account of moneys received and paid in connection with their paper. Witness said he had received money from advertisers and others, and had paid them over month by month until recently, when acting under legal advice he retained them pending the result of the action, his counterclaim being in excess of the company's claim. This was his first failure.

Mr. Hansell, on behalf of the trustees, examined the debtor further regarding his connection with the *Contract Record*, and Mr. Lewsey, a creditor, questioned him in relation to the claim of the Debenham estate trustees. Mr. Stewart Bevan, on behalf of the trustees, also examined the debtor, who stated in reply to the Registrar, that he had always regarded the £2,000 provided by the late Mr. Debenham as capital and not as a loan.

The examination was concluded.

Appended is a list of the principal creditors:—

UNSECURED.

Andrews & Nanson, Brixton Road, S.W.	£23
Bailey, E. H., Leamington	43
Bennett, A. R., Queen Anne's Chambers, S.W.	30
Debenham, deceased, Trustee of	5,028
Burns & Co., Ltd., J., Kirby Street, E.C.	24
City of London Electric Lighting Co., Ltd., Great Winchester Street, E.C.	15
Crook, Mrs., Waddesden	500
Friedmann, J. S., Mayence	26
Gas Light & Coke Co., Westminster	22
Gaze, J. W., 113, Fleet Street, E.C.	11
Grant, H., 23, Brook Street, W.	550
Harrild & Sons, Norwich Street, Fetter Lane, E.C.	16
Herring Dewick & Co., 85, Cannon Street, E.C.	567
Lacey, Mrs., Cross Park, Chiphay, near Torquay	998
Lewsey, H. A., 206, Upper Thames Street, E.C.	221
International Trade Exhibitions, Ltd., Broad Street House, E.C.	16
Mitchell & Son, W., Manchester	14
Shackell, Edwards & Co., Ltd., 5, Red Lion Passage, Fleet Street, E.C.	114
Parrott, Dr., East Dulwich	47
Penrose & Co., Ltd., A. W., 109, Farringdon Road, E.C.	41
Puetz, A. L., 65, Long Acre, W.C.	17
Smallpiece & Co., Guildford	40
Metropolitan Water Board, Rosebery Avenue, E.C.	10
Bullen & Debenham, Cheapside, E.C.	11
Rodgers & Gilbert, 4, Walbrook, E.C.	120
Biggs, C. H. & E. J., 139-140, Salisbury Court, E.C.	21

FULLY SECURED.

Penstone, G. R., Walbrook, E.C.	£257

PARTLY SECURED.

Shone & Ault, 47, Victoria Street, S.W. (security valued at £70)	£200
Taylor, G. M., Caxton House, Westminster (security valued at £35)	50
Sceptre Life Assurance Co., Ltd., Finsbury Pavement, E.C. (security valued at £125)	512

CONTINGENT LIABILITIES.

Sundry subscribers to the *Electrical Engineer*	70

PREFERRED.

Rent of 65, Shoe Lane	112
" Glebe Lodge	106
" 139-40, Salisbury Court, E.C.	68
" Flat	100
Rates, taxes and wages	284

Re WILLIAM TERRELL GARNETT (trading as W. T. Garnett's Cable Co.), Barkerend Mills, Bradford, electric cable and wire manufacturer.—At the Bradford County Court, before Judge Graham on May 18th, the debtor applied for his discharge in bankruptcy. The Official Receiver (Mr. Durrance) reported that the receiving order was made on August 12th, 1908, on the debtor's petition, and the public examination was concluded in October. The liabilities to rank for dividend were estimated at £31,329, but the proofs actually admitted up to date were £34,271, while there were other probable claims amounting to £75. The difference between the estimate and the actual was chiefly due to the fact that the amounts owing were understated in a number of instances. The free assets were estimated to produce £8,386. Up to the present they had realised £7,607, while about £50 worth were still outstanding. The balance available for cost and for distribution among unsecured creditors would probably be £7,483, instead of £8,129 as estimated by bankrupt. A first dividend of 3s. had been paid, and a further dividend of 1s. was probable. In reply to Mr. Durrance, Mr. Garnett said that he was not prepared to make any offer. Mr. Richard Watson, for the bankrupt, said that the Committee of Inspection had expressed their sympathy with the bankrupt, and he had their best wishes that he would succeed in his application. Mr. Watson pointed out that Mr. Garnett's heavy losses on copper were not due to speculation. The purchases had been made for orders in hand. Mr. Durrance said he thought it only fair to state that the investigation of the affairs of the bankrupt showed nothing that reflected dishonour upon him although something might be said about his business capacity. Mr. Garnett had undoubtedly been unfortunate. Judge Graham granted a discharge, but suspended same for two years. His Honour said that if he had the power to have allowed the discharge earlier he would have done so.

BRIDGEWATER & WRIGHT, electrical engineers, 78, York Road, King's Cross.—This case was in the list of public examinations to be heard on Wednesday last week, at the London Bankruptcy Court, before Mr. Registrar Giffard. Mr. E. Leadam Hough, senior Official Receiver, reported that there was a dispute as to the person or persons who constituted the firm and carried on the business. He had filed an application for an order of adjudication, to be heard in Chambers on the following Tuesday, and he consequently had to ask for an adjournment of the sitting for public examination until June 16th, when he would know whether there was anyone who could be examined. His Honour directed the hearing to stand over accordingly.

Re THOMAS WARD, lately a director of the Electrical Instrument Manufacturers, Ltd., Freezywater, Waltham Cross.—The adjourned public examination of this debtor was fixed to take place at the Edmonton Bankruptcy Court on Monday, but he was not present. Mr. F. T. Garton, the Assistant Official Receiver, said that the examination was fixed for so long ago as November 2nd last. There was an examination of the debtor in the following month, but since then the case had been adjourned from time to time on account of his health. At the last Court the Official Receiver suggested that these adjournments ought to come to an end, and that the examination should be adjourned *sine die*. There seemed to be no probability of debtor's recovery at an early date, and therefore he (Mr. Garton) now asked for an adjournment *sine die*. He also applied to the Court to adjudge the debtor bankrupt. The debtor's solicitor, he said, had been informed of the intended application. In the absence of the debtor and his solicitor the Registrar decided to adjourn both applications to his next Court.

LANCELOT W. DE GRAVE, electrical engineer, &c., 19, Queen Street, Derby.—Receiving order made May 12th, on debtor's own petition.

J. R. W. MIDDLETON & A. E. E. DANIELS, electricians, Dover.—First meeting, May 22nd; public examination, May 27th, both at Canterbury.

J. G. S. CUNNINGTON & H. P. ALLISON (Laing, Wharton and Cunnington, electrical engineers and contractors, 7, Great Newport Street, London).—A receiving order was made on May 12th on debtor's own petition. First meeting to be held May 25th, and public examination June 23rd, at Carey Street, W.

Stepney Municipal Contracts.—At this week's Council meeting a resolution was to be considered instructing the General Purposes and other Committees to bring up an amendment to the Council's by-laws, providing to the following effect:—

It shall be an instruction to all the Committees of the Council, in recommending the acceptance of tenders to the Council, to recommend the acceptance of the lowest tender, unless the Committee making the recommendation are satisfied, after careful inquiry and adequate consideration, that the tenderer or tenderers lower than the tenderer recommended:—

(*a*) Is or are not financially sound;

(*b*) Has or have not in practice paid their employés the Trade Union rate of wages as agreed to by the Employers' Association and Trade Unions and as in practice obtain (*vide* By-law 85);

(*c*) Has or have previously accepted a contract of the Council or other public body which has not been carried out satisfactorily.

Catalogues and Lists.—MESSRS. SIEMENS BROS. AND CO., LTD., Caxton House Westminster, S.W.—Supplement to Catalogue No. 506, dealing with the stereometer, an instrument for localising foreign bodies by means of the X rays. The instrument and its methods of application are fully described and illustrated. It is claimed for this apparatus that it does optically what previous types of localisers have done with cross threads, &c., whilst it is more accurate and is constructed with the precision of a microscope. We understand that it has been found that with the stereometer foreign bodies in the eye can be localised with absolute accuracy. The instrument is portable, and can be employed by anybody, whether they have had experience or not in stereoscopic radiography. A very fine catalogue of between 70 and 80 pages has also been issued by the firm on the subject of telephone cables. It is a very finely-produced work, with pictures in half-tone and many cable sections in colour, all executed in very fine style on a good quality paper. The views include the Woolwich Works exterior, and a number of the machines used there in the manufacture of telephone cables, including longitudinal paper-covering machines, twinning machines, large cabling machines, hydraulic lead press, tank and test house, telephone cables prepared for testing, also spiral paper and copper screening machines. Descriptions of the different processes of manufacture are given, and direction may be drawn to the "Multiple-twin" method of arranging the conductors of cables. The coloured illustrations show composite telephone and telegraph cables, also telephone cables, including some of the more important trunk and other lines manufactured by the firm for the British Post Office. Useful electrical and mechanical data for telegraph and telephone engineers are included. Tabular particulars are set out of air-space lead-covered telephone cables with conductors of different weights. Reprint No. 508 B is also issued relating to transformers for use with instruments.

THE WORTHINGTON PUMP CO., LTD., 153, Queen Victoria Street, E.C.—New catalogue of 88 pages wherein the firm give full descriptive matter accompanied by tabulated speeds, capacities and dimensions of their Worthington centrifugal pumps. The pictures are, as usual, of a very high class, and a number of them are of motor-driven pumps. A telegraphic code and some pages of useful data are given at the end of the book. Copies of the catalogue can be obtained on application to the above address.

MESSRS. VICKERS, SONS & MAXIM, LTD., 32, Victoria Street, S.W.—Pamphlet very fully describing the Vickers one-lock adjustable reamer, and giving a table of prices of same. This is one of the latest manufactures of the firm, and it is claimed to combine all the advantages of a solid reamer, with the convenience of the adjustable variety, the mechanism ensuring a high degree of accuracy.

Messrs. David Rowell & Co., Westminster, S.W.—List W554, in which fencings, iron gateways, carriage sheds, iron and steel-framed workshops, and so forth are illustrated and priced.

Messrs. Elliott Bros., 36, Leicester Square, W.C.—Small neatly designed list, illustrating a number of their micrometers. The firm are now making these precision micrometers at their factory at Lewisham, and they are hoping for the support of the British engineering trade now that it is not necessary for such apparatus to be imported.

Walsall Hardware Manufacturing Co., Hatherton Works, Walsall.—New 44-page catalogue, in which are set out particulars of their enamelled and galvanised steel conduits and accessories. The list is very fully illustrated, and a number of new fittings, together with a complete range of patent grip fittings and accessories, are included. We understand that many of the prices have been considerably reduced.

Messrs. Davis & Timmins, Ltd., York Road, King's Cross.—List of their standard wing nuts showing them full size, and giving a table of dimensions and prices, Tapped Whitworth and British Association standards. These nuts are claimed to come out much cleaner and of an altogether better finish than the ordinary wing nut finished up from a casting.

Messrs. Morris & Lister, Ltd., Carlton Works, Coventry.—List No. 14 describing, showing and giving prices and dimensions of the "Bruston" patent transformer switch.

It is claimed that this switch considerably increases the economy obtainable with metal-filament lamp installations.

Messrs. Veritys, Ltd., Manchester.—New leaflets as follows:—No. 601 dealing with "Aston" d.c. ventilating fans; No. 602, new "Typhoon" desk and bracket fans for d.c.; and No. 603 giving prices, &c., of the "Delhi" desk fan for alternating current.

Langdon-Davies Motor Co., Ltd., Southwark Works, Deverell Street, S.E.—Circular showing illustrations of their electric motors and their applications to different kinds of service.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—New season's catalogue of 12 pages giving illustrated and other particulars, together with dimensions and prices, of the "Simplex-Isaria" electric fans and small motors for direct and alternating current for any voltage and periodicity. Desk and bracket patterns, porthole and cabin types, and ceiling fans with wood blades, occupy the first half of the catalogue, the remainder being devoted to small motors for fan-driving and for driving sewing machines, and to starting and regulating rheostats.

The Abbey Electric Co., 17, Victoria Street, S.W.—Illustrated leaflet describing and giving prices of their improved pattern "Abbey" flame arc lamps.

The Electrical Co., Ltd., Charing Cross Road, W.C.—Section XI/3 of their catalogue, giving 18 pages of illustrations and tabulated sizes, weights, prices, &c., of their quick-break knife switches, change-over switches, &c.

Large Gas Engines.—Three repeat orders, aggregating 3,000 h.p., for large gas engines to be direct coupled to electric generators, have recently been placed with Messrs. Ehrhardt and Sehmer. Last week they received a repeat order from the Skinningrove Iron Co. for a 1,200-h.p. engine to work on blast-furnace gas. This is an extention to two smaller engines of the same make now in course of erection. They have also received an order for an identical engine for use in a large chemical works in this country, where one of their 1,200-h.p. engines has been running on Mond ammonia recovery producer gas during the past two years. It is considered that the latter order should assure those engineers who have doubted whether the engines that have proved so satisfactory with blast-furnace gas would be equally satisfactory on producer gas, that the difficulties they have anticipated are imaginary.

"Fluxite."—The Auto-Controller and Switch Co. have recently received a repeat order from the Royal Arsenal for a large quantity of "Fluxite" soldering paste.

Private Meetings.—J. Defries & Sons, Ltd., 147, Houndsditch, London, E.C.—A further very largely attended meeting of the creditors of the above was held on Friday, May 14th, at the Institute of Chartered Accountants, Moorgate Place, E.C. Mr. Whinney (Messrs. Whinney, Smith & Whinney, chartered accountants), the liquidator of the company, presided. A statement of affairs as at March 19th last, the date of the appointment of the receiver and manager, was presented. According to this the gross liabilities amounted to £141,533, of which £119,578 was expected to rank. The assets were estimated to realise £66,476, but after providing for the preference claims and the debentures, the net assets were reduced to £46,860. The estate thus showed a deficiency on paper of £72,718. It was stated that a conference of the principal creditors had been held, and they were of the opinion that it would be best to leave Mr. Whinney to act as sole liquidator, and not to hamper him in any way. The position was discussed at very considerable length, and eventually it was decided to leave Mr. Whinney to act as sole liquidator. A committee of inspection was suggested, but this was not approved of.

F. J. Pullin, trading as Pullin Bros., 203, Newington Butts, London, S.E., dealer in electrical fittings, &c.—The adjourned meeting of the creditors of the above was held on May 14th, at the offices of Messrs. Poppleton & Appleby, chartered accountants, 4, Charterhouse Square, E.C. Matters were discussed at very considerable length, and eventually it was decided to accept a composition of 7s. 6d. in the £, payable as to 2s. 6d. in cash, 2s. 6d. in three months, and the balance of 2s. 6d. in six months.

The Auto-Claw Co., Ltd., Curtain Road, London, E.C.—In pursuance of the Companies' (Consolidation) Act, 1908, a meeting of the creditors was held on May 11th. It was reported that a meeting of the shareholders was recently held, when a resolution was passed in favour of the voluntary liquidation of the company, and Mr. Child was appointed to act as the liquidator in the proceedings. After discussing the position disclosed, a resolution was passed in favour of the appointment of Mr. E. H. Hawkins (Messrs. Poppleton and Appleby, chartered accountants, 4, Charterhouse Square, E.C.), as liquidator. The Concordia Electric Wire Co. were nominated to make the necessary application to the Court in the matter. A committee of inspection was also appointed, consisting of the representatives of Messrs. H. A. Jackson & Co., Messrs. Davis and Timmins, and the Concordia Electric Wire Co.

Dissolutions and Liquidations.—Marples, Leach and Co., Ltd.—A notice in the *London Gazette* states that at a meeting held at 20, Jermyn Street, S.W., on May 14th, it was resolved to wind up voluntarily, with Mr. R. Clements and Mr. G. Ambach as liquidators, it having been proved "to the satisfaction of this meeting that the company cannot, by reason of its liabilities, continue its business, and that it is advisable to wind up same." A meeting of creditors will be held at 28, Artillery Lane, E.C., on May 29th. Creditors must send particulars of debts, &c., to the liquidators at Adail Building, Artillery Lane, E.C., by July 14th.

Sperling's Nut-Lock, Ltd.—This company is winding up voluntarily, with Mr. H. Wood, 9, Lenton Avenue, Nottingham, as liquidator.

Messrs. Baker & Anderson, electrical engineers, 14, High Street, Sutton, Surrey.—Messrs. W. Baker, W. Anderson and G. J. Hawkins have dissolved partnership, Mr. Baker retiring. The business will be continued under the old style by the remaining partners, who will attend to debts.

Polesworth Electrical Appliance Co., brick, tile and electrical appliance manufacturers, Polesworth.—Messrs. G. W. Shackleton and C. D. Lavington have dissolved partnership. Mr. Shackleton will attend to debts.

Auto-Controllers, Ltd.—A petition for winding up this company has been presented by Mr. E. G. Bryant, electrical engineer, 6, Town Hall Avenue, Bournemouth, and it is to heard at Poole, Dorset, on June 14th.

George Cooke & Co., electrical engineers, Hawthorn Street, Wilmslow.—Messrs. George Cooke and W. H. Sellers have dissolved partnership. Mr. Cooke will attend to debts.

Pantelegraphy Publishing Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. J. B. Wandless, 13, Old Jewry Chambers, E.C., the liquidator, by May 29th.

Book Notices.—*Collected Researches of the National Physical Laboratory.* Vol. V. 1909. Teddington: From the Director.—The volume which has recently been issued contains, besides accounts of several researches on subjects outside the scope of this journal, papers on the Variation of Manganin Resistances with Atmospheric Humidity, the Secular Changes of the Standards of Resistance at the N.P.L., and the Determination of the Constants of Mercury Standards of Resistance—all by Mr. F. E. Smith; on a Comparison of the Board of Trade Ampere-Standard Balance with the Ayrton-Jones Current-Weigher, by Mr. T. Mather, F.R.S., and Mr. F. E. Smith; and on a Method of Comparing Mutual Inductance and Resistance with Two-phase Currents, and Compensation for Self-Inductance in Shunt Resistances, by Mr. A. Campbell. We have published abstracts of some of these researches. The complete papers show with what thoroughness and accuracy the work of the Laboratory is performed, and reflect the greatest credit upon their authors, whose skill and patience in manipulation are on a par with their ability as scientists to devise new apparatus and methods, and who, with their colleagues, under the direction of Dr. Glazebrook, have, in a few years, placed the Laboratory in the very front rank amongst kindred institutions, and—crowning triumph—have lately compelled even a British Government to recognise their *rôle* of *National* Physical Laboratory, and their fitness to investigate the problems of aviation. Our only criticism of the volume before us is that it possesses no title page in the technical sense; there is absolutely no address, no name of printer or publisher, and no intimation as to whether the contents are copyright or not, whether the volume can be purchased, or where it can be obtained. Surely the absence of this information is an unfortunate omission. The *Bulletin* of the U.S. Bureau of Standards contains full particulars of its origin.

The Commercial Engineer's Pocket Book: Electricity Supply. By F. H. Davies, A.M.I.E.E. London: Alabaster, Gatehouse & Co. 1909. Price 1s. 6d. net.—This is "a handbook for publicity department managers, electricity supply and contractors' representatives," and has been compiled partly from published data, partly from the author's own practice, only such data being included as have been found by him to be of every-day use. The contents are divided into lighting, power, machinery, heating and cooking, and miscellaneous sections, with a good index, and a number of blank pages at the end for the user's own notes. Many of the data are in the form of tables, giving such particulars as are required by the canvasser or contractor for answering inquiries of every kind relating to the ordinary applications of electricity to domestic and industrial purposes. These include also particulars as to the cost of gas lighting and power, and we note that the author points out the necessity, when estimating the true cost of power in the case of a private plant, of taking into account interest and depreciation, value of space occupied, &c., as well as the bare cost of fuel or energy. A remark to the effect that small non-condensing steam engines sometimes consume as much as 100 lb. of water per i.h.p.-hour has, we notice, been questioned in a daily contemporary; it is, however, well known that experiments have frequently

proved this to be the case. This is, we believe, a unique compilation of data of this kind, and should be very useful to electricity supply engineers and contractors.

The Engineering Index Annual for 1908 is about to be issued; we have frequently had occasion to express our appreciation of the value of this publication, which can be had at a reduced price if ordered before publication from *The Engineering Magazine*, Kean Street, W.C.

"High Frequency Currents." By H. B. Crook. London: Baillière, Tindall & Cox. 1909. Price 7s. 6d. net.

"General Lectures on Electrical Engineering." By C. P. Steinmetz. Schenectady (N.Y.): Robson & Adee. 1909. Price $2.

"Elektrische Uhren." By Dr. A Tobler. Leipzig: A. Hartleben. 1909. Price M. 4.

Trade Announcements.—The Electric Lighting and Tramways Accessories Co. have started business at 73 and 75, Finsbury Pavement, E.C. The manager of the firm is Mr. A. W. Boreham, who was for many years with the Consolidated Supply Co., Ltd., of Canonbury, and the British Electric Car Co., of London and Manchester.

We understand that Mr. H. V. Kramer, late managing director of Kramos, Ltd., of Bath, has severed all connection with that company, and has formed in conjunction with the Witton Engineering Works, Birmingham, the Witton Kramer Electric Tool and Hoist Co., to carry on the manufacture and sale of electric suspension and mono-rail trolley hoists, electric lifting magnets, electric portable drills and grinders, and brake solenoids.

Mr. Geo. Cooke has taken over the business of Messrs. Geo. Cooke & Co., electrical engineers, of Hawthorn Street, Wilmslow, Cheshire.

With reference to the disastrous fire which occurred at the premises of Simplex Conduits, Ltd., 61-65, High Bridge, Newcastle-upon-Tyne, last week, we learn that the fire broke out on the floors above, and spreading downwards, completely gutted the building. The firm have, however, opened further premises situated at 60, Pilgrim Street, corner of High Bridge, Newcastle-upon-Tyne, and have made the necessary arrangements to obviate any delay in the execution of orders; complete stocks of material will be carried in the new premises.

Mr. J. H. Ashton, electrical engineer, has opened business premises at 19, Dry Hill Park Road, Tonbridge.

New Aegma Lamp.—The Electrical Co., Ltd., of 121-125, Charing Cross Road, W.C., inform us that they are now in a position to supply Aegma metallic-filament lamps of 16 c.p. for 100 to 130 volts, with bulbs of neat design and small size, similar to those of carbon-filament lamps, which can, therefore, be used with existing shades. The efficiency is 1·2 watts per British candle-power, and the average life is given as well over 1,000 hours.

Mechanical Vacuum Pumps.—Referring to our description of the "Z" electric lamp works in last week's issue, in which we said we believed that this was the only instance in which a mechanical pump was employed for exhausting metallic-filament lamps, Messrs. Lacy-Hulbert & Co., Ltd., of 91, Victoria Street, S.W., write informing us that for some years a well-known company of incandescent lamp makers in England has been using their small patent mechanical vacuum pumps for exhausting lamps. They have received repeated orders for these pumps, and believe that about one dozen of them are now in use by this one company. With these exhausters, which are very simple and inexpensive, they are able to obtain a vacuum of 29·6 in. with the barometer at 30·1 in., and the makers are confident that by a slight modification of their machines they can obtain still better results. The system of using a number of small units instead of one large one appears to them to present distinct advantages. A leaflet accompanying their letter shows that these pumps are made in sizes from 9 to 165 cb. ft. per minute, and are belt-driven. The smallest size takes ½ h.p., and measures 16½ × 10½ × 16 in. Their Catalogue No. 3 also shows a variety of air compressors, vacuum pumps, pneumatic appliances, &c.

LIGHTING and POWER NOTES.

Aberdeen.—The Corporation and the Suburban Tramway Co. have agreed to Mr. W. H. Patchell, of London, acting as arbiter on the question of the price of energy to be paid to the Corporation by the company, and also on the length of agreement between the two bodies.

Ashby-de-la-Zouch.—Mr. Hewitt, of London, has submitted an E.L. scheme to the U.D.C. The estimated cost of supplying about two-thirds of the town is £15,000. The matter is being considered by a Committee.

Barnes.—The U.D.C. has reduced the price of energy for lighting from 4d. to 3½d. per unit, with suitable discounts. For heating and cooking the price has been reduced from 1½d. to 1¼d. per unit.

Beckenham.—The Council on Monday night passed a resolution in favour of the principle of the Electric Lighting Acts Amendment Act, and against an amendment limiting local authorities' power to provide, let for hire and fix, repair and remove lamps, electric lines, &c., in cases in which they employ a contractor. Owing to the improved coal costs prevailing in connection with the Council's electricity station, the Council has decided to let the proposal to extend the condensing apparatus stand over until next year. It has also abandoned for the present the idea of having a railway siding to the works.

Birmingham.—The annual report of the Electric Supply Department shows that some 24,406,227 units were supplied during 1908-9, or some 4 million more than in the previous year. This includes 10,796,024 l.t. units for lighting and power, 1,827,794 h.t. units for power, and 11,782,409 units for the tramways. The revenue account, after meeting special expenditure on buildings and plant abandoned, shows a balance of £85,114 to profit and loss account. From this account a sum of £7,000 is carried to renewals. The net result of the year's work, after meeting all charges, is a surplus of £10,000, which it is proposed to pay over in aid of the improvement rate.

Bradford.—Apparently as the result of its experimenting, the City Council has decided to retain the public gas lighting in Manningham Lane, and, we might add, to retain its reputation as one of the worst lighted cities in the country.

Braunton.—It is understood that the canvass of the town for E.L. consumers, undertaken by Messrs. Crompton & Co., has proved satisfactory, and that there is every prospect of the scheme being carried out.

Bridlington.—A L.G.B. inquiry was held on May 12th into the application of the T.C. for a loan of £5,100 for electric lighting purposes, including £446 in respect of excess expenditure. There was no opposition, but the inspector, Mr. H. R. Hooper, deprecated the practice of the Council of pooling previous sanctions so that he could not be informed of the details of the £446 overspent.

Brighton.—The T.C. has been recommended by the Lighting Committee to supply energy to Messrs. C. R. Smith and Sons, Ltd., Britannia Mills, Portslade, the company to install motors up to 100 h.p. rated capacity, and to pay a fixed charge of £265 per annum, plus 6d. per unit metered. For lighting the price of energy is to be 6d. per unit for the first hour's average daily use of the maximum demand, and 2d. afterwards.

Cleethorpes.—On May 11th a L.G.B. inquiry was held into the application of the U.D.C. for a loan of £4,000 for E.L. purposes. There was no opposition.

Crewe.—The electric lighting undertaking, which is now being worked at a profit, has handed over its first contribution of £500 towards the relief of the general district rate. The profits last year were nearly £1,000.

Dublin.—The South Dublin B. of G. has decided to accept the Ampere Electrical Co.'s offer to provide an electrical installation in the Union, and to take full charge of the same on a 10-years' agreement at £750 per annum. The L.G.B. is to be asked to sanction the arrangement.

Gravesend.—The T.C. has decided to extend the mains so as to supply the officers' quarters at the barracks, provided the revenue will be at least 10 per cent on the expenditure.

Grimsby.—The annual report on the electrical undertaking shows gross and net profits of £9,264 and £3,184 respectively. The latter compares with £2,442 in 1907-8. The units sold were over two millions, including 479,791 for traction, 684,500 to the railway company in bulk and 276,796 for power. It was decided to apply £500 to the relief of the rates this half-year, and a similar sum next half-year, if considered advisable.

Heysham.—The B. of T. has revoked the 1904 E.L. order.

Leeds.—The result of the year's operation of the electricity department, ending March 31st last, is a surplus of £8,248, as compared with £6,921 in the previous year. Actually the revenue, £104,148, shows a decrease on 1907-8, but the working expenses, £34,271, are £1,000 lower, and extraordinary renewals only figure at £2,138, as compared with £13,372 in 1907-8. Thus, despite somewhat heavier financial charges, the surplus on the year is higher. During the year 12,395,118 units were sold at an average of rather over 2d. per unit, this comparing with 12,412,861 units and 2·19d. per unit in 1907-8. The output represents 6,230,308 lighting units, and 6,164,810 power units, the former being a decrease of about 430,000 units (actually over half a million units on private lighting), and the latter a considerable increase on the 1907-8 figures. For lighting, the average price was 3·01d. per unit, with 19·69 units used per lamp installed, and a lamp revenue of 4s. 11d.; for power the average price was 1·01d., consumption per horse-power installed, 686 units, and revenue £2 17s. 8d. The decreased consumption of energy for private lighting is attributed to the metallic-filament lamp; the substitutions reported to the department represent a reduction equal to 11,490 35-watt lamps, There were 313,627 35-watt lamps installed at March 31st, 1909, and 9,942 h.p. of motors, which figure will be much increased by installations now in hand. The maximum load was 8,220 kw., compared with 8,300 kw. in 1907-8; an additional 3,000-kw. turbo-alternator is being installed, bringing up the station capacity to 15,740 kw. The total capital expended at the end of the year was £916,914.

London.—A joint conference of the Metropolitan B.C.'s and the London Electric Supply Companies was held on 13th inst. to consider the question of linking up the various electric supply

undertakings. A resolution was passed favouring the carrying out of a scheme jointly by the Councils and companies, and a consultative committee was appointed, composed equally of representatives of municipal and company undertakings.

G.P.O. Power Station.—For some years the P.O. power station, with its ugly chimney, has been a conspicuous landmark near Blackfriars Bridge. We understand that "rapid progress" is being made in equipping it at the present time—the plant including some 3,000-H.P. of 6,600-volt three-phase turbo-generators, which will be available by the end of the year. Duplicate feeders are to be laid across Blackfriars Bridge to the G.P.O., and in course of time the supply will be extended to Mount Pleasant.

Stepney.—The annual report of the electricity undertaking up to March 31st last was issued this week. The capital outlay up to that date was £323,034, and of this amount £35,073 was spent during the 12 months under review. The net result of the trading account shows a balance of income for the year over expenditure of £18,185, and an increase in the number of units sold from 5,712,684 to 6,833,865, producing an income of £43,865, which sum includes £6,012 in respect of street lighting and a further sum of £852 in regard to the sale of energy to other departments in the Council. As compared with last year, the income increased by £5,484 and the expenditure by £4,401. Although the expenditure had increased in total the amount per unit sold had decreased from ·924d. to ·92d. Deducting from the gross profit the payment of interest and instalments of loans, there remains a balance of £1,808, which the Committee decided should be dealt with by carrying £791 to next year's account, £100 to reserve account, the balance to be laid out in expenditure in the nature of capital. The average income per unit sold for all purposes decreased during the year from 1·624d. to 1·54d., in connection with which it was pointed out that the average charge made by all the companies and local authorities of London was 2·67d. per unit; 1,542,496 units were sold for power at 1d., and on the alternative charge to consumers with a minimum annual bill of £120, 1,016,089 units were sold at ½d. and 5s. per H.P. demanded per month.

Hornsey.—During this week an electrical exhibition, arranged for by the Corporation, is being held at the Athenæum, Muswell Hill, and a large variety of heating, cooking and lighting exhibits are on view. Messrs. Siemens Bros. & Co. are showing a 15-ft. board, demonstrating the various applications of their "C.S." wiring system, which, no doubt, contractors will like to see before the exhibition closes to-morrow (Saturday). One of the advantages of this system is that the "Stannos" wire, having a continuous copper sheath, can be used as a concentric system with uninsulatad return, where the installation is isolated, or is fed through a transformer from public mains; this enables installations of metallic-filament lamps at 25 or 50 volts, which are now so popular, to be carried out on very simple and economical lines. The Sun Ray Reflector Co. has an exhibit of adaptable Nosma reflectors; the Electrical Co. displays fans; then there are Radiant ovens, in connection with which demonstrations of cooking are being given. An electrical piano, a coffee roaster, printing machinery and electro-medical apparatus are also features of the show, which has received a large amount of local support.

Maldens and Coombe.—The County of London Electric Supply Co. has informed the U.D.C. that it cannot see its way to proceed with the E.L. Order, 1907. The introduction and development of the metallic-filament lamp has so completely revolutionised the supply industry and altered the prospects of working the undertaking at a profit, that the directors did not feel justified in incurring the expenditure necessary to develop the district.

Monmouth. — Last week-end Messrs. Callender completed the cable connection between the Treforest and Cwmbran networks, and in future the supply of energy in the Eastern and Western Valleys will be given from the Treforest generating station, situated about 3 miles south-east of Pontypridd, the Cwmbran station being shut down and held in reserve. The new trunk main passes over the mountain as an overhead pole line, to Ystrad Mynach from which point it runs underground, along main roads to Newbridge, where it joins the Cwmbran network. At this point it is intended to erect a new sub-station for giving a supply to the Celyneu Collieries. The Treforest Electrical Consumers' Co., who, by arrangement with the South Wales Power Co., now take over the working of Monmouthshire districts, has, since 1907, been supplying the Rhonddas and the Vale of the River Taff from Cilfynydd, through Pontypridd and Taff's Well, to Whitchurch.

Morley.—A deficit on the working of the electrical undertaking for the past year, amounting to £1,799, resulted. There have been many special charges, during the year, and if these are deducted, the actual working deficit is £1,226.

Newton-le-Willows.—The B. of T. has been asked by the U.D.C. to grant another extension of time for carrying out the E.L. order.

Saffron Walden.—The B. of T. has revoked the 1904 E.L. order.

The "Temeraire."—This, the third Dreadnought vessel, was commissioned at Devonport on the 15th inst. Its electrical equipment is stated to be ahead of that of any previous warship, including 150 motors and 140 miles of wiring. The applications of electricity include pumping, hoisting ammunition, cooling, ventilating, gun-firing, air-compressing, also the lighting, telephone, fire control, bell and wireless systems. We gather that there are 95 sets of auxiliary engines, and that the wireless apparatus has a radius of 1,100 miles.

Walsall.—With reference to the resolution of the T.C. referring back the question of borrowing £35,000 for extending the electricity undertaking, Councillor Stead, chairman of the Electricity Commitee, has intimated his resignation from the Electricity Committee.

A Sub-Committee has been appointed to further consider and report on the question of extensions.

Widnes.—It was reported at a meeting of the T.C. on May 12th that the Council had been advised by the engineer not to let the E.L. order drop, as developments had taken place.

TRAMWAY and RAILWAY NOTES.

Birmingham.—The working of the Corporation tramways last year resulted in £105,403 gross profit and £51,039 net profit. Working expenses show an increase of £21,323, of which £9,000 is due to increased wages. The Tramways Committee proposes to place £21,550 to reserve, making a total for that fund of £87,016; the balance of £29,489 will go to the rates.

Bradford.—The work of adapting cars for the through service between Bradford and Leeds, which, it will be remembered, have gauges of 4 ft. and 4 ft. 8½ in. respectively, is approaching completion. The car trucks are being equipped on the plan devised by Mr. Spencer, and a sufficient number will be available for a 10-minute service just after Whitsuntide, thus doing away with the necessity of changing cars at Stanningley as at present.

Brighton.—The working of the Corporation tramways for the year ending March 31st last, shows a net loss of £2,420, which is to be taken from the reserve. The revenue amounted to £47,089, a slight increase on the previous year, but working expenses were over £2,000 in excess of 1907-8; the manager comments on the excessive price paid for energy, which he submits is responsible for the poor financial results shown.

Chile.—The *Diario Oficiel* of March 5th publishes a decree granting to the Compania Elétrica de los Andes a concession to utilise the waters of the River Aconcagua to the extent of 1,000 H.P. with the object of generating electric energy to furnish the town of Los Andes and district with electric lighting and traction.

Continental Notes.—Russia.—The construction of the electric railway from Moscow to Troïtza-Serguiev is about to be begun. The contract has been signed and sent to St. Petersburg for ratification.—*Board of Trade Journal.*

Italy.—A project is being considered for a 16 km. line from Chieti, the principal town in the province of Abruzzi, to Francavilla-on-the-Sea. We recently erroneously referred to this matter under the heading of Austria.

Spain.—The *Gaceta de Madrid* announces that the Sociedad Anónima "El Tibidabo" have applied for a concession for the construction and working of an electric tramway from the Vallvidrera line to Tibidabo.

Portugal.—A degree has been issued authorising the municipal authorities of Coimbra to contract a loan of £33,750 for the installation of an electric tramway service in that town.

Cork.—The drivers and conductors employed by the Cork Electric Tramways and Lighting Co. returned to work on Sunday morning, and the service of cars was resumed. Negotiations for a settlement of matters in dispute bad been in progress for some days, and were amicably arranged on Saturday evening. The strike, which lasted over a fortnight, caused considerable public inconvenience in the city. The strikers have secured no concessions.

Edinburgh.—The Corporation Tramway Committee recommends the extension of the cable tramways from the present terminus in Gorgie Road to the entrance to the new markets, powers for which have been obtained. A conference is to take place with the promoters of the Colinton tramways with the view of coming to an agreement safeguarding the city's interests.

Kirkcaldy. — The Tramway Committee is to open negotiations with Dysart, a neighbouring burgh, with the view of running the Corporation cars there.

Leeds.—It is announced that the extension of the Leeds Corporation system from Horsforth to a point near the boundry of Yeadon and Guiseley will be opened this week; the final section of the route to Guiseley is expected to be complete in six weeks' time.

Leith.—The tramway extension to Granton, over a mile in length, was recently inspected by Col. Von Donop, R.E., who fixed the compulsory stopping places and the maximum rates of speed at the various points. The line is a double one except at Trinity Bridge.

Newcastle-on-Tyne.—The annual statement of account has been issued by Mr. Ernest Hatton. This shows a gross income of £204,123, as compared with £211,318 for the preceding year; or an average per car-mile of 11·42d., as against 11·50d. for 1908. The total working expenses were £122,609, as against £116,852 for 1908, which represent 6·86d. and 6·36d. per car-mile respectively for 1909 and 1908, an increase of ½d. per car-mile. The sum of £81,513 is carried to the net revenue account, as against £94,466 for 1908. The net profit for the year, after meeting financial charges, is £7,557, which it is suggested should go to the reserve and renewals fund, and which would make a credit balance on that account of £62,699. The balance brought forward on this account on March 31st, 1908, was £62,322, and the appropriations for renewals during the past year totalled £7,181. Last year the net profit was £19,477, which was entirely appropriated to the reserve and renewals fund.

Rawtenstall.—On Saturday last the local tramway undertaking was officially inaugurated. The system includes 6½ miles of track in Rawtenstall and 2½ in Bacup, constructed to a gauge of 4 ft. with 100 lb. per yard "Sandberg" steel rails. The whole of the rail jointing has been done by the Thermit process, and the track work has been carried out by Messrs. Underwood, of Stalybridge. The overhead work, mostly span wire construction, has been carried out by the B. I. & H. Co.; the trolley wire is of the grooved type, with mechanical ears. Special short-circuiting section insulators are fitted on gradients, and automatic trolley reversers at each terminus. Sixteen double-deck cars are provided, all fitted with the Raworth regenerative control system. The power station contains an equipment of Lancashire boilers and Browett-Lindley triple-expansion engines coupled to E.C.C. compound-wound interpole generators. Körting ejector condensers, using river water, are fitted to the engines. An E.C.C. balancer, an automatic booster by the Lancashire Dynamo Co., used in connection with a 240-cell D.P. battery, two Crompton track boosters, and a Westinghouse rotary converter set, consisting of two 100-kw. rotaries which can be coupled together and used as a motor-generator or run independently as converters, are included in the equipment. The rotaries with transformers are used for supplying three-phase current at 3,000 volts to Crawshawbooth and Whitewell Bottom, where step-down transformers are provided for distributing locally at 400 and 230 volts. Although the Corporation is operating the Bacup tramways, the question of a bulk supply for lighting, &c., is still in abeyance.

Torquay.—The Tramway Co. has conceded the points mentioned by the Paignton Urban Council as a condition precedent to its approval of the extension of the lines from the Torquay boundary to Paignton. There has been a good deal of friction over these matters, and the House of Lords Committee considered that the consent of the Paignton Council was unreasonably withheld. But the Tramway Co. could not get on successfully without this consent, and the complete surrender now made by the company goes far to justify the action taken by the Council. One of the principal points in the controversy was a stipulation by the Council that in the event of its taking over the undertaking of the Paignton Electric Light Co., the Tramway Co. should obtain from the Paignton Corporation Works the energy necessary for the tramway service within the area on the same terms as it does from the Torquay Corporation. There will now be no substantial difficulty in the way of passing the Extension Bill.

Weston-super-Mare.—The U.D.C. has received from the Weston and District Electric Supply Co., Ltd., notice of its intention to apply to the B. of T. for an extension of time until 1911 for completing the tramways authorised by the 1900 and 1901 Orders. The Council has decided not to oppose the application.

TELEGRAPH and TELEPHONE NOTES.

Canal-boat v. Telephone Pole.—At the Exeter County Court recently, the National Telephone Co. claimed from Mr. Hurdle, of Topsham, £12 14s. damages caused by defendant's vessel of 70 tons colliding with a telephone pole, while being towed along the Exeter Canal. The case for the plaintiffs was that the captain allowed the drifting vessel to carry away the pole which supported the trunk line, on account of his not having provided himself with proper means of controlling her. The defence stated that the accident was the result of a sudden squall. The judge awarded judgment to the defendant.

Earth Currents.—On Friday last, according to the *Scotsman*, the work of the Edinburgh Postal Telegraph Department was interrupted on account of most of the circuits having been affected by earth currents. It was about 4 p.m. when the currents made themselves felt, and for about an hour they increased in strength steadily. Between 5 p.m. and 6 p.m. they decreased, and shortly after six o'clock they had disappeared, but about nine o'clock they returned, having travelled south, for they affected communication with Bristol.

International Code Telegraphy.—The London Chamber of Commerce has received from the Postmaster-General a letter regarding the use of artificial code words, from July 1st next. The principal points in which the regulations relating to code have been altered are as follows:—(1) An express stipulation has been inserted in order that there may be no doubt as to the condition which was previously implied, namely, that the standard of pronounceability to which artificial code words must conform is the *current* usage of the eight languages specified; (2) The administrations of Great Britain, France and Germany have been authorised to give the approval of the International Telegraph Union to such codes as are voluntarily submitted and are found upon examination to be prepared upon a proper basis.

New Atlantic Cable.—With further reference to this matter, we note in the *Times* that the President of Argentina on the 15th inst. announced that he would shortly submit for ratification by Congress a contract enabling Argentina, without expense, to make use of a direct cable to Europe.

Paris Telegraph Strike.—The second strike of postal and telegraph employés has resulted in a complete fiasco, with disastrous consequences to the strikers, of whom some 600 have been dismissed. A similar number will meet with the same fate unless they promptly return to duty. Attempts have been made to bring about a general strike, but although a large majority of the Federal Committee of the General Confederation of Labour voted in favour of supporting the strikers, it is very questionable, at the time of going to press, whether anything will come of it. Only the electricians and builders' labourers are ready to strike at once; the railwaymen are not likely to take action, and other trades require several days' notice.

Several acts of malicious injury to telegraph wires have been reported in the neighbourhood of Paris.

Trinidad.—A special committee of the Legislative Council has reported against the purchase of the Trinidad Telephone system; a company has been formed recently in Canada for the acquisition and improvement of the system, and will be permitted to increase the rates. It will be accorded a concession for 30 years.

Venezuela.—The Government has signed an agreement with the French Cable Co., which removes all difficulties between them, and the company was to reopen its regular public service on the 13th inst.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Victoria.—50 coin attachments for the P.M.G. See "Official Notices" May 7th.

Victoria.—Eight sections of common-battery switchboard and subscribers' apparatus for Hawthorn Exchange. See "Official Notices" May 7th.

Melbourne.—May 25th. 1,125,000 flame, and 70,000 ordinary, arc lamp carbons for the City Council. See "Official Notices" May 7th.

Melbourne.—July 14th. One direct-current steam-driven generating set of 1,000, 1,250 or 1,500 kw., for the Council. See "Official Notices" May 14th.

Melbourne.—June 1st. 69,750 incandescent lamps for the Council. See "Official Notices" May 14th.

Melbourne.—September 14th. The Postmaster-General requires tenders for (A) apparatus in Exchange: one common-battery switchboard, of eight sections in all, together with all associated frames, racks, power plant, and parts as specified in Specification No. 230; (B) apparatus on subscribers' premises: 2,850 telephone wall sets, 150 telephone table sets, 3,000 protectors to Specification No. 189, extension switches, switchboards, &c. Specifications may be seen at the Electrical Review offices.

Queensland.—Telephone material for the P.M.G.'s department. See "Official Notices" May 7th.

New South Wales.—One photometer, &c., for the P.M.G.'s department; also a branching multiple magneto switchboard. See two "Official Notices" May 14th.

Belgium.—May 26th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the supply of 116,000 metres of copper contact wire and 92,000 metres of copper wire for overhead feeders in connection with electric railways.

Birmingham.—June 8th. Chimney-stack and extensions to engine foundations, &c., at Summer Lane generating station, for the Corporation.

Colwyn Bay and Colwyn.—May 27th. Stores for the electricity department. See "Official Notices" to-day.

Dudley.—June 10th. A motor-generator with switchgear, for the Corporation. See "Official Notices" to-day.

Farnworth.—May 24th. Extra-high and low-tension cables, and 10 circuit-breakers, for the U.D.C. electricity department. Mr. R. B. Leach, electrical engineer.

France.—Paris.—May 28th. The Under-Secretary of State for Posts and Telegraphs requires tenders for chemicals and other material for Calland and Leclanché batteries, in five lots.

Germany.—Tenders are about to be invited by the municipal authorities of Wandsbeck for the establishment of a central electric lighting station in the town, at an estimated cost of £150,000.

Gillingham.—May 28th. One Diesel engine coupled to three-phase alternator and exciter (120 or 140 kw.) for the Electricity Committee. See "Official Notices" to-day.

Grimsby.—June 7th. Two superheaters for Stirling boilers, also renewal of dripping bars in existing cooling towers, for the Corporation. See "Official Notices" to-day.

Hornsey.—May 28th. Cables for the T.C. See "Official Notices" May 14th.

London.—St. Pancras.—July 10th. Arc lamp carbons for the B.C. See "Official Notices" April 30th.

Poplar.—May 26th. Two electric fans for the workhouse laundry, for the Guardians. See "Official Notices" May 14th.

Stepney.—The Electricity Committee is about to invite tenders for meters, demand indicators, time switches and carbons.

L.C.C.—May 25th. Electric lighting, &c., at schools at Putney and Peckham. See "Official Notices" May 14th.

L.C.C.—June 15th. 200 double-deck roof-covered car bodies, 200 car sets of maximum-traction swing bolster trucks, and 200 complete electrical equipments for operation upon both conduit and overhead trolley systems. See "Official Notices" May 14th.

Woolwich.—New tenders are to be invited for the pipe work of the cooling pond at the Plumstead generating station.

Manchester.—May 29th. Various stores for the Electricity Department. Mr. F. E. Hughes, secretary to the department.

Mexborough.—June 8th. 100-kw. engine and generator, switchboard extensions, piping, and water purifier and softener for the U.D.C. electricity works. See "Official Notices" May 7th.

Salford.—May 24th. Coal for the electricity works for one year.

Sophia.—June 1st. The District Finance Commissioners require tenders for insulators, insulator supports and galvanised iron.

Southampton.—The tramways manager has been directed to obtain prices for a motor-driven air compressor.

Sundry heavy cables for low-tension trunk mains for the electricity department. See "Official Notices" to-day.

Spain.—Manresa.—Tenders have lately been invited for the concession for the working of the telephone system in the town of Manresa during a period of 15 years.

Almeria.—The Harbour Works authorities at Almeria have just invited tenders for the supply and erection of six electrically-operated cranes.

Balearic Isles.—May 29th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the working of the State telephone system in the town of Palma de Mallorca, Balearic Isles, during a period of 15 years.

Yarmouth.—Tenders for 12 months for oils and grease, iron, bolts, nuts, brake-blocks, electrical accessories and miscellaneous stores. Specification from General Manager. Closing date: noon, Tuesday, June 1st.

Warrington.—June 2nd. Cables, motors and transformers for the electricity department. See "Official Notices" to-day.

Whitehaven.—May 25th. One balancing set for the Corporation. See "Official Notices" May 14th.

CLOSED.

Bristol.—The T.C. has accepted the tender of Messrs. F. & W. Bracher for the lighting of Avonbank Station, at £397; that of Messrs. P. Jolin & Co. for the electric light installation at Kingstown Close School, at £169; and that of the Oliver Arc Lamp, Ltd., for a year's supply of arc-lamp carbons, at £200.

Canada.—The successful tenderer for the erection of the telephone line in connection with the Hydro-Electric installation is Mr. Wyse, formerly manager of the Brantford Electric Co. The contract runs into nearly $100,000.

Chichester.—The following tenders were received by the West Sussex Education Committee for the electric light installation at the new Secondary Schools at Chichester:—

F. J. Privett, Southsea	(accepted)	£155
Strange & Son, Tunbridge Wells		140
Miskin & Rice, London		164
Page & Miles, Ltd., Brighton		212

Cleckheaton.—The U.D.C. has accepted the tender of Messrs. Siemens Bros., Ltd., for cable, at £723.

Dudley.—The Education Committee has accepted the tender of the Dudley Electrical Co. for the electric light installation at the new high school for girls.

Edmonton.—The B. of G. has accepted the tender of Messrs. B. E. Nightingale, of Albert Embankment, London, for a transformer house, switch-room, &c., at the new infirmary, at £1,038.

Falkirk.—The offers of Messrs. Scott & Sons, Glasgow, for permanent way, and the British Insulated & Helsby Cables, Ltd., for overhead equipment have been accepted by the Tramway Company for the extension of the system to Laurieston. Work will commence almost immediately.

Glasgow.—The T.C.'s Committee on Halls and Buildings recommended the acceptance of the offer of Messrs. W. R. Underhill for the lighting work at the Dixon Halls, at £86.

The Tramways Committee recommended the following offers for acceptance:—

Brass tubing.—P. & W. Maclellan, Ltd.
Rubber cables.—W. T. Glover & Co., Ltd.
Tool steel.—Ibbotson Bros. & Co., Ltd., and L. N. Ledingham & Co.

London.—Stepney.—The Electricity Supply Committee recommends the acceptance of the tender of Messrs. Foster Bros., Ltd., for the pipework, hot well, &c., for the Blyth's Wharf extension scheme, at £3,989; and that of the Rees-Roturbo Manufacturing Co., Ltd., for motor-driven pumps, at £1,969. The tenders for the two contracts were as follow:—

Foster Bros., Ltd.	(recommended)	£3,989
E. Danks & Co., Ltd.		4,250
J. Spencer, Ltd.		4,674
J. Wilson & Co.		4,973
E. Le Bas & Co.		5,250
Babcock & Wilcox, Ltd.		5,650
Fraser & Fraser (£300 added for work omitted in main tender)		6,337
Rees-Roturbo Manufacturing Co., Ltd.		Do not quote.

Rees-Roturbo Manufacturing Co., Ltd. (with patent ventilated motors)	(recommended)	£1,969
Ditto (with enclosed motors)		2,521
Foster Bros., Ltd.		2,531
J. Spencer, Ltd.		2,539
Fraser & Fraser (£155 added for work omitted in main tender)		2,541
J. Wilson & Co.		2,566
E. Le Bas & Co. (does not include all plant specified)		2,643
E. Danks & Co., Ltd. " "		2,650
Babcock & Wilcox, Ltd.		3,150

For the removal of tank and pipework from Osborn Street station to, and re-erection at, Blyth's Wharf, the tenders were as follows:—

Newton, Chambers & Co., Ltd.	(recommended)	£159
Dean Bros.		202
Williams & Co.		289
W. Badger		420

Fulham.—Messrs. Oliver, Clark & Co., Ltd., of Shepherd's Bush, have received the contract to carry out the whole of the electric lighting of the grand-stand and grounds at the English Church Pageant, to be held at Fulham Palace grounds in June.

Kensington.—Messrs. E. Newbald & Co., of Sutton, are to carry out the electric light installation at the Workhouse Chapel and Guardians' Offices, at £169.

Southwark.—The B.C. has accepted the following tenders for ampere-hour type meters:—

Electrical Co., Ltd.—5 amperes, 25s.; 10 amperes, 25s.; 15 amperes, 29s.; 4s. extra for self-adjusting brushes.
Gillespie & Beales.—5 amperes, 31s.; 10 amperes, 32s.; 15 amperes, 38s.
Venner & Co.—50 amperes, 54s.; 100 amperes, 68s.

Whitehaven.—The T.C. has accepted the tender of Messrs. Whipp & Bourne for duplicate switchgear for feeder pillars.

Wolverhampton.—The T.C. has accepted the tender of Mr. Trentham, of Handsworth, for constructing tramways from Queen Square, through Worcester Street and Lea Road.

FORTHCOMING EVENTS.

Liverpool and District Electrical Association.—Saturday, May 22nd. Visit to Formby Power Station (Liverpool and Southport Railway). 3.10 p.m. train, Exchange Station.

Institution of Electrical Engineers (Newcastle Section).—Monday, May 24th. At 8 p.m. At the Armstrong College, Newcastle. Annual general meeting, followed by paper on "The Wireless Telegraph Installation at Cullercoats," by Mr. Sorensen.

Royal Society of Arts.—Wednesday, May 26th. At 4 p.m. Paper on "The Manufacture of Nitrates from the Atmosphere by the Electric Arc," by Herr S. Eyde.

OUR CONTRACTORS' COLUMN.

We are now publishing this section of the Electrical Review in our advertisement pages. (This week's list of buildings appears on pages 54 and 56.) The constantly increasing demands upon our editorial space, and the fact that this particular matter is intended for immediate use by the electrical contractor and supplies trades, and is not of permanent value for binding up in the half-yearly volumes, have rendered the adoption of this course desirable.

NOTES.

The International Candle.—The National Physical Laboratory has issued a Memorandum as to Photometric Units, which confirms the announcement made in our issue of the 7th inst., on the authority of the *Electrical World*, N.Y., as to the new international standard unit of light. It had been intended to make this announcement simultaneously in America, France and Great Britain, but "circumstances prevented this"—the Bureau of Standards, taking time by the forelock, issued it in its circular of April 1st. The agreement described in the Memorandum has the approval of the Gas Referees, and the photometric standards of the National Physical Laboratory are being maintained in accordance with it.

The Memorandum explains that comparisons have been made during the past few years between the units of light maintained at the several centres, both directly and by means of carefully seasoned carbon-filament electric standards, and it has been found that while the French bougie decimale is identical with the British pentane unit within the errors of experiment, these are 1·6 per cent. less than the standard candle of the United States, and 11 per cent. greater than the Hefner unit. The Bureau of Standards of America agreed to reduce its standard to the same value as the French and British units, and the new unit therefore = 1 pentane candle = 1 bougie decimale = 1 American candle = 1·11 Hefner unit = 0·104 Carcel unit. The Hefner unit = 0·90 of the proposed new unit.

The proposal to call the common unit of light to be maintained jointly by the national standardising laboratories of America, France and Great Britain the "International Candle" has been submitted to the International Electrotechnical Commission, and through it to all the countries of the world which are represented on that Commission.

It is hoped that general approval will be secured, and that in the near future the term "International Candle" for the new unit will have official international sanction.

The unit of light at the National Physical Laboratory is that given by the 10-c.p. Harcourt pentane lamp, which was prescribed for use by the Metropolitan Gas Referees, burning at normal barometric pressure (76 cm.) in an atmosphere containing 8 litres of water vapour per cb. metre. It is the twentieth part of the standard defined by the International Conference on Units of 1884.

Americans Investigating Brazilian Water Powers.—A correspondent, writing from Maceio, Brazil, under date April 26th, says that a party of six American engineers recently arrived there from New York, on their way to the Paulo Affonso Falls. Some of the party are mining engineers, and the others, under the charge of Mr. Lenz (of Messrs. Lenz & Mole, engineers, Broadway, New York), are hydraulic and electrical engineers. This party intend examining and making tests on the falls, with the view to establishing a power station there, but only (in the first instance) for supplying power for gold dredging in the river, and for working any minerals they may find in the vicinity. It may be only a small station, or it may be a large one, according to what luck the prospecting portion of the party have. The party are travelling in the interests of an American syndicate. I am under the impression that it is only a matter of time before these Falls will be utilised for supplying electrical energy on a big scale.

Drivers of the L.U.T.—In Tuesday's Parliamentary Papers, Mr. Gwynn asks the Home Secretary whether the Chief Commissioner of Police has recently been giving licences for men to be employed as drivers on the London Electric tramway system without enforcing the usual tests of their capacity.—Mr. Herbert Samuel, answering in the negative, states that the practice until recently was to accept the certificates of the London County Council or the London United Tramway Co. as to a candidate's ability to drive an electric tramcar, and, provided the police inquiries as to character proved satisfactory, to issue the licence on that certificate. Recent events had made the Commissioner think it desirable to alter the practice as regards the London United Tramway Co. Candidates put forward by that company are now required to satisfy the police of their ability to drive as well as of their character. The certificates of the London County Council are accepted as heretofore.

Artificial Nitrates from the Atmosphere.—Our correspondent in Chile informs us that the Chilian authorities have been much concerned with the above matter in connection with what is happening at Notodden, in Norway, and recently several lengthy communications on the subject have been appearing in the local Press:—

"From alarmist reports through the foreign Press of the rapid progress made in the production of artificial nitrates, the interested parties here were taking it rather to heart, as until now they have had an easy monopoly in the world's markets. On the strength of this feeling, they appointed a delegate—Senor Alejandro Bertrand—to attend a Conference in Paris last year treating with the subject scientifically, and to inquire into the whole question of "fertilisers," with the result that his reports have put all feelings of alarm at rest. Naturally the owners of Salitre Fields, in Chile, are keenly alive to any development that might take place with the new discoveries of artificial fertilisers, and are kept well informed independently through their European houses, and know exactly all that takes place. Although the remarkable developments made in the production of artificial nitrates from the atmosphere, which were reported on former occasions in the Electrical Review, are extremely interesting from a scientific standpoint, and no doubt they have found a field of usefulness already, especially where purity is a predominant factor, as required in chemical manufactures; but for fertilisers such purity is not required, and, indeed, it is believed by many authorities that the Chilian product (nitrate of soda or saltpetre), with its 95 per cent. purity, is for most soils the best. It is when considering the chemical market, and the production of nitric acid, &c., that the artificial method counts with direct means of purification, as it appears from statistics to cost less than does the salitre when raised to 100 per cent. Of the salitre exported, it is estimated that about 75 per cent. is consumed in agriculture.

"Some question has arisen as to the life of Chile's saltpetre supplies; from recent official estimates it is said that 120 million tons are calculated to exist within sight and in possession of operating concerns. It is also stated that further in the interior of Tarapacá (Northern Province) in the *pamper* regions unexplored by capitalists, that with an exportation of two million tons per annum the natural supplies are good for at least 200 years."

Municipal Tramways Association.—A meeting of the Managers' Section of this Association is to take place on May 27th and 28th (Thursday and Friday next) at Newcastle-on-Tyne. After a welcome from the chairman of the Corporation Tramways Committee, Sir J. Baxter Ellis, on Thursday, the following subjects will be submitted and discussed:—

"Description of the Newcastle Tramways System," by Mr. E. Hatton.

"Charges for Energy for Traction Purposes," by Mr. J. M. McElroy.

"Medical Examination of Motormen and Conductors; What the Standard of same should be," by Mr. J. B. Hamilton.

A trip on the Tyne in the steam launch *Sir W. Stephenson* follows, and Manors Power Station can be visited. On Friday the subjects to be discussed are:—

"Time Meters," by Mr. H. Mozley.

"Maintenance of Track and Roadway," by Mr. W. M. Rogerson.

"Transfer Tickets," by Mr. A. Ellis.

Luncheon at the Town Hall and a visit to Byker car works and depôt follow.

Electric Shock Fatality.—An adjourned inquest was held at Bootle on Thursday, last week, on the body of George Lee, aged 33 years, who died at Bootle from the effects of burns received on the Liverpool-Southport Electric Railway on the 8th inst. Deceased, who had worked for Mr. James Gregson, contractor, was a relayer, and on the 8th inst. he was employed with other men relaying the rails on the electrified portion of the L. & Y. Railway, near to Marsh Lane, Bootle. It is supposed that, while crossing the line, he stumbled and fell on the live rail. Every assistance was given, but he died on the way to the hospital. In order to remove any possibility of doubt, a post-mortem examination was made, and this showed that death was due to shock to the nervous system caused by the electricity going through the body. It was stated by a fellow workman that he was perfectly acquainted with the system and with the dangers of the live rail. A verdict of "Accidental death" was returned.

Fatality.—On Wednesday, last week, the Manchester Coroner held an inquest on the body of Fredk. Thomas, a young electrician, of Birmingham, who had latterly lived in Manchester, and was in the employ of the Post Office. On the 5th inst. he was joining a telephone cable in a manhole in Bury New Road, Prestwich. A coke fire was being used to heat soldering irons about a yard away from the manhole. A fellow workman put charcoal into a brazier, which he lit with naphtha. The naphtha blazed up and the deceased's clothing became ignited, and he died from burns received. A verdict of "Accidental death" was returned.

Metal-Filament Lamps and Gas.—Among the causes of the drop in business in new gas-burners experienced by the Welsbach Incandescent Gas Co. during 1908, the chairman, Lord Weardale, names the competition experienced from metal-filament lamps.

Canada.—An Electrical Association for the Province of Quebec was recently formed in Montreal.

Institution and Lecture Notes.—Institution of Electrical Engineers (Newcastle).—At the annual general meeting of the Section, to be held on Monday next, the following nominations for the Committee for 1909-10 will be considered:—Chairman: Prof. H. Stroud; vice-chairman and hon. sec., Mr. C. Faraday Proctor; Past chairmen: Messrs. H. L. Riseley, James Pigg, A. L. E. Drummond. Committee: Messrs. G. G. Stoney, G. Ralph, W. D. Hunter, C. S. Vesey Brown, A. S. Blackman, C. Turnbull, A. H. Law, Prof. W. M. Thornton, Messrs. J. A. Anderson, E. Fawssett, H. W. Clothier, H. Henderson, R. Rutherford, T. M. Clague, W. T. Dalton, G. S. Whitmore; hon. treasurer, Mr. W. A. Clatworthy. After the meeting Mr. Sorensen will read a paper on "The Wireless Telegraph Installation at Cullercoats."

Institution of Electrical Engineers.—No other nominations having been received, the nominees of the Council, of whom a list was published in our issue of April 23rd, have been declared duly elected. At the annual general meeting last night the report of the Council and statement of accounts was to be received, and afterwards a paper was to be read by the President on "Some Tests and Uses of Condensers." The statement of accounts shows that the income for the past year was £11,623, and the surplus of income over expenditure was £3,253. The total assets amounted to £51,553, of which the building fund represented £35,754.

Institution of Mining Electrical Engineers.—A meeting of this Institution will be held at the University College of South Wales, Cardiff, on May 22nd at 6 p.m., Mr. Sydney F. Walker presiding, for the purpose of forming a local section of the Institution and electing members of council, officers, &c.

Institution of Electrical Engineers (London Students).—The Students' Committee proposes for this year a tour to visit the large engineering works in Germany, and permission is being asked to see, amongst others, the works of Messrs. Siemens & Halske (dynamo works), Bergmann, Siemens-Schuckert, Allgemeine Elektricitäts Gesellschaft, Dr. Cassirer & Co., and the Charlottenburg Technical Institute, the Reichsanstalt, an electric railway, and a gas-engine-driven generating station in the neighbourhood of Cologne. The visit will take place during the second week in July. It is estimated that the tour should not cost more than £10, and Messrs. Thos. Cook & Son have in hand the arrangements. Those desirous of accompanying the party should apply to the hon. sec., Mr. E. W. Moss, at 20, Huddleston Road, Tufnell Park, London, N., at once.

Appointments Vacant.—Teachers (evening) of electrical engineering and wiremen's work for Tottenham Polytechnic.

Imperial College of Science and Technology.—The Goldsmiths' Company has offered a gift of £50,000 to the Imperial College, to go towards the construction of new lecture rooms, laboratories and workshops for the engineering department. The gift has been accepted, and the governors have passed a resolution cordially thanking the company for their munificence.

Air-Rifle Ranges at Croydon.—The Croydon Corporation Tramways Athletic Club have recently had fitted up at each of their depôts a miniature air-rifle range for the use of the tramway employés, and will be glad to hear from any similar air-rifle club that would like to compete with them.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. H. H. Clare has been appointed station engineer to the Woolwich undertaking (vice Mr. F. H. Edwards resigned to go to Erith), at a commencing salary of £180 per year. Mr. H. W. Mansfield, the present leading fitter, has been appointed works foreman on the staff, on probation for six months, at a commencing salary of £150 per annum.

In addition to the presentation from his Committee mentioned last week, Mr. T. Roles, the city electrical engineer of Bradford, has been presented with a silver rose bowl by the staff, as a wedding present. The staff and employés of the electricity department held a smoking concert on Friday last, at which the chair was occupied by Mr. C. W. Salt (chief assistant engineer), and the presentation was then made.

Tramway Officials.—Mr. Cecil Barber, on leaving the post of works engineer and traffic manager to the Bournemouth Corporation Tramways Department, was presented by the staff with a bronze electric light group and a leather suitcase. Mrs. Barber was made the recipient of a fitted luncheon and tea basket and an Indian lizard purse. The great respect and esteem in which all branches of the staff held Mr. Barber was referred to by Mr. F. T. Olding, the chief assistant in the traffic department, who made the presentation.

General.—The West Ham Education Committee on Monday decided to recommend to the Council that the salary of Mr. P. R. Friedlaender, lecturer in the Electrical Engineering Department, be raised from £200 to £230 per annum by annual increments of £15.

Mr. A. H. Dykes (of Messrs. Handcock & Dykes) has been appointed chairman for the ensuing year of the Electricity Committee of the Beckenham U.D.C.

The *Times* states that the Hon. Arthur Stanley, M.P., who recently joined the board of the British Electric Traction Co., has retired, pending the determination of a business in which he has conflicting interests.

Mr. Robert Gray, a member of the Electrical Department staff at Perth, who is about to leave for Buenos Ayres, has been presented by the staff with a safety razor and combination knife. The presentation was made by the head of the department, Mr. Brown.

The *City Press* states that Dr. Lewis Jones, the head of the electro-medical and X-ray departments at St. Bartholomew's Hospital, has accepted the presidency of the electro-medical conference to be held in London in July.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Universal Telephone and Electrical Co., Ltd. (68,317).—This company's annual return was filed on March 16th, when 400 ordinary and 400 founders' shares had been taken up out of a nominal capital of £10,400 in 2,000 ordinary shares of £5 each and 400 founders' shares of £1 each. £2 10s. per share has been called up on 400 ordinary shares, resulting in the receipt of £1,000; £400 is considered as paid on 400 founders' shares. Mortgages and charges: Nil.

W. T. Henley's Telegraph Works, Ltd. (13,795).—This company's annual return was filed on March 23nd, when the entire capital of £400,000 in 40,000 preference and 40,000 ordinary shares of £5 each had been taken up. £5 per share has been called up on 39,880 preference and 39,616 ordinary shares, resulting in the receipt of £362,480; £37,520 is considered as paid on 120 preference and 7,884 ordinary. Mortgages and charges: £150,000.

CITY NOTES.

Veritys, Ltd.

The directors report that during the 12 months ended January 31st, 1909, the business showed a net trading profit of £24,988 (including £86 brought forward). After deducting interest on mortgage and loans, directors' fees, bad debts, depreciations and sundry amounts written off amounting to £14,260, there is available for dividend £10,728. When the dividends on the 5 and 6 per cent. preference shares, and that of 5 per cent. for the year on the ordinary have been paid, there remains £236 to carry forward. The report contains the following remarks on the business generally. During the year under review, although trade has been very restricted, especially abroad, and prices have ruled low, the company has maintained its turnover and increased its profits. At the present time the rate of orders is well maintained at the depôts, and the factories are busy with orders in hand for Government, municipal bodies and trade customers. The catalogue of the company has just been published in a new three-volume edition. Some thousands of these are in course of distribution, and should lead to a considerable increase of business in the current year. The electrical cooking and heating apparatus put on the market by the company during the year has been adopted by the Admiralty, and is increasing in favour with the public. As the use of electric cooking and heating is now being encouraged by the electric supply companies in London and the provinces, this department should continue to expand. The whole of the cost of experiments in connection with this development has been written off the trading profits. With the object of paying off the 6 per cent. debenture of £40,000 and the bank loans raised for the purpose of extending the works and also for providing additional capital, the company has created 5 per cent. mortgage debenture stock to the amount of £60,000. [This is now being issued at 97½ per cent., as mentioned below.—Eds.] The shareholders are invited to forward applications for this stock.

The important contracts for the Admiralty and other Government Departments alluded to in the last report have been completed, and have led to gratifying repeat orders. At the present moment the company have in hand apparatus for the new *Dreadnought* battleships and submarines, and also considerable orders for motors, supplies, &c., for the War Office, Post Office and other Government departments, in addition to their regular trade business.

Prospectuses.—*Veritys, Ltd.*—This company has been before the investing public with an issue of £60,000 5 per cent. mortgage debenture stock at 97½ per cent. There is already fully paid £140,000 preference capital, one-half at 5 per cent. and the other half at 6 per cent. interest, as well as £55,980 in ordinary shares and £200 in management shares. The new stock is secured by deeds giving a first charge over the whole undertaking of the company, including a specific charge on the lands, buildings and fixed plant at Birmingham subject to mortgages for £11,200, and a floating charge over all the other assets, present and future. The company has large works at Birmingham, and many depôts in important centres in this country, and it also has agencies in every important foreign market. The spirit of progressive enterprise pervades all the departments of the firm, and there are aggressive

steps being taken to largely extend the company's export trade. Our readers will have observed that Mr. George Verity has only recently returned from an extensive foreign tour in the interests of the business and there is certain to be considerable benefit accruing as the result of his personal study of, and touch with, markets to which British firms have not in the past, to our way of thinking, given sufficient attention. The proceeds of the present issue will be applied partly in redeeming temporary loans and advances, amounting to £45,000, which had been laid out in progressive development, and partly in providing additional working capital. For the past four years the profits, after providing for all charges, including repairs and maintenance, depreciation and directors' fees, and interest on the mortgages on the works at Birmingham, but before charging interest, discount and expenses of temporary loans and debentures, have been £11,240, £13,198, £13,889 and £14,036, thus averaging £13,091 per annum. The annual amount required for the service of the present issue, including sinking fund to redeem the stock, is £3,931. These figures show how well the issue is secured. The healthiness of the position of the company is revealed in the report for the past year, that has just been published, and from which we give some extracts on another page; the outlook for the future we regard as very promising. In spite of the general complaint of hard times, the profits advanced in 1908, but the interest on the ordinary dividend has not been increased, the additional profit being put to depreciation, &c. The current year shows, we understand, a still further increase in orders received. The entire issue has been underwritten by Messrs. Vertue, Lubbock & Co., at 3½ per cent., but apart from that, the success of the issue is thoroughly assured.

Mountain & Gibson & Thornewill, Ltd.—There are being offered for subscription (as will be seen from the prospectus appearing among our advertisement pages to-day) 60,000 shares of £1 each at par, and 808 5 per cent. debentures of £50 each, in this company. The firm of Mountain & Gibson, Ltd., of Bury, are well known as builders of tramway and railway rolling stock, but the increase of their home and export trade rendering more extensive premises necessary, it was arranged to purchase the works of Thornewill & Wareham, Ltd., engineers, of Burton-on-Trent, and the works at Bury will be transferred to the latter place as quickly as practicable without interfering with the business. This step will enable the company to accept many favourable orders which it has been impossible to undertake up to the present. The proceeds of the present issue will be applied to the purchase of the businesses, the redemption of £30,000 debentures of the vendor company and as additional cash capital for general purposes.

In addition to the shares and debentures now offered for public subscription, there are to be allotted to the vendor company as part payment of the purchase money 51,734 shares of £1 each, and 292 debenture bonds of £50 each; 400 of the latter bonds are held in reserve. There will thus be £55,000 debentures issued, which at 5 per cent. per annum, will require £2,750 to meet interest charges. The profits on the business of Mountain & Gibson, Ltd., were for three years ending June, 1908, £5,509, £5,003, and £6,386 per annum respectively, before charging interest, income-tax, formation expenses, depreciation and special expenditure on experimental work and initial outlay in working out standard designs. This last experimental item in the three years aggregated £18,342, and in order to write off these items in a short period of years, £6,734 of the profits named above were applied to this purpose at June, 1908. The business will be taken over as from June 6th, 1908, from which date it will be considered as having been carried on for the benefit of the company, any profits will belong to the company and all liabilities will be discharged by the company. The profit statements of the accountants end at June 6th, 1908, and the prospectus gives no indication of the course of business or the profits made in the intervening period.

The company will obtain the benefit of the business connection of Thornewill & Warham, Ltd., Burton, but will not assume any of its liabilities, except obligations in respect of work actually in progress, nor make any payment for its goodwill. The purchase price of the Burton works is £30,000 (£6,000 debentures, £10,000 in shares and £14,000 in cash, of which £12,600 will be applied in paying off the debentures of the selling company). The stock and work in progress at Burton is to be paid for at a valuation. The directors estimate that very important savings, amounting to several thousands per annum, will be possible at the Burton works, and "that the future annual profits of the company when these works are in full operation should admit of the payment of a substantial dividend on the shares of the company after providing for the interest on and fund for the redemption of the debentures, and leave a surplus for reserve."

Canadian Mineral Rubber Co., Ltd.—This company has been offering for subscription an issue of £170,000 6 per cent. first mortgage debenture stock. Two of the directors are connected with the Winnipeg Electric Railway Co., and one is president of the Toronto Electric Light Co.

Chipping Norton and District Electric Light and Power Co., Ltd.—There are being offered for sale £1,500 first mortgage 5 per cent. debentures of £100 at 96.

Submarine Cables Trust Co., Ltd.—The Marquess of Tweeddale presided at the annual meeting held on 13th inst. He said that the receipts were £24,266 for the year, after deducting expenses, against £22,784 in 1907. The increase was not due to any real increase in the dividends on their investments, but was owing to altered dates for the receipts of dividends from the Eastern Telegraph Co. After paying the two half-yearly coupons there was a surplus of £6,210, out of which they had purchased 50 certificates, carrying forward £228.

Brush Electrical Engineering Co., Ltd.

The twentieth ordinary general meeting was held on Tuesday at the Electrical Federation Offices, Kingsway, Lord Vaux of Harrowden presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, May 24th, page 816), explained that he had retained his position longer than he intended in order to complete the arrangements with the issue of the prior lean debenture stock, which was only finished at the end of last year. He would now retire from the chairmanship, which will be taken by Mr. Garcke. Proceeding to deal with the report, he said he regretted that the balance-sheet showed so poor a result of the company's operations. The explanation lay in the fact that they had been going through a period of extraordinary trade depression, and although the prospects now seemed a little brighter, they were still very far from having emerged from the state of stagnation into which business generally, and their own industry in particular, had fallen. In previous years, when they had suffered from slackness in one department of their works, the other departments had, as a rule, helped to make up the shortage. Last year, however, in all departments, both on the electrical engineering side and on the car side, the volume of orders was very much below the average. It was difficult to trace or to satisfactorily explain all the causes of this abrupt falling off, but so far as contracts for generating plant for central electric lighting stations were concerned, there was no doubt that the largely - extended use of metallic-filament lamps had for the time being affected the engineering side of the industry severely. This new lamp saved about 70 per cent. in current as compared with the carbon-filament lamp hitherto in use, and although it was at present much dearer, the difference in price was saved many times over by the reduced cost of current. Consumers of electricity for lighting purposes who obtained their supply from central station circuits were amongst those who benefited most by this invention, and they had eagerly adopted it, with the result that many of the central lighting stations had experienced a temporarily reduced load, and the usual orders for extension plant had been postponed. They believed that the new lamp would further popularise the electric light, and that the reduced cost of current would attract many fresh consumers, and although, therefore, the immediate effect had been to check orders for new generating plant, they felt that this would only be a temporary phase, and they were looking forward in the near future to a considerable impetus in the demand for electric power-house plant. In this connection, he might say, that, in common with other suppliers of carbon-filament lamps, they had found their business in this department affected by the growing use of metallic-filament lamps. They had, therefore, been negotiating for, and hoped shortly to, complete arrangements by which they would acquire selling rights for a metallic-filament lamp which had proved to be very successful, and was now being sold in large numbers on the Continent. One effect of the lack of orders for generating plant had been to increase the competition for the few contracts that were to be placed. Their competitors had all felt the pinch, and foreign competition also had to be met. All these adverse circumstances had combined to keep prices for steam and electrical machinery low. He mentioned at the last meeting that the demand for tramway and railway rolling stock had been small. This state of affairs, he regretted to say, had continued throughout 1908, and still continued. One unsatisfactory feature was that some of the larger tramway undertakings in this country had lately taken to building their own cars, he meant so far as the bodies were concerned. By doing this their cars must cost them a great deal more than if they were bought through the medium of competitive tenders, but this was a truth which could only be realised by experience, and in the meantime the regular car-building shops of the country were suffering from a lack of work. New promotions of tramway and light railways had been very few, a state of affairs which, he was afraid, must be largely attributed to the legislative obstacles that existed. Efforts were being made to bring home to the Board of Trade that further progress in the direction of improved traffic facilities by means of light railways and tramways had been, and must continue to be, seriously hampered until the obstacles were removed. He mentioned this matter so that they might understand some of the difficulties of the situation from the point of view of the useful employment of labour in their car-shops, and he sincerely hoped that before long some of the legislative disabilities to which he had referred would be removed and the way opened to fresh enterprise. As regarded main line rolling stock, the railway companies had been driven by troubles of their own to economise in every possible direction. Competitive train services had been largely discontinued, as a result of mutual working arrangements, thus releasing a good deal of rolling stock formerly in use but now held in reserve. Orders for new stock had consequently been few. If they looked now at the general profit and loss account, they would see that the balance to the credit of the account at the end of 1908 was only £28,213, as against £63,294 for 1907. The general charges amounted to £20,329, as against £22,421, showing a reduction of over £2,000. The item of maintenance was naturally down a good deal—£5,181, as compared with £8,441. Less work meant less wear and tear on buildings and plant, and consequently less expense for upkeep. From this point of view the item of maintenance was not one that they cared to see at a low figure, and it would certainly increase as soon as their works got back to their normal state of activity. In the meantime, the buildings and plant had been maintained in their usual state of high efficiency. The net profit and loss account showed that interest on debenture, stocks, and on bank loans absorbed £17,798, as compared with £18,597 last year. They had also applied £24,173 to writing down stocks and bad and

doubtful debts in order to clear their books of various items which did not now represent value. The net result was to show a loss of £39,357 on the year's operations. Turning to the balance-sheet, the property account was increased by £8,060 for additions during the year. Patents and goodwill remained at the round sum of £100,000, the amount to which the item was written down under their reduction of capital. Stock and work in progress stood at the comparatively small sum of £79,586, due chiefly to the fact that the amount of unfinished work in hand at the end of the year was greatly below the average, and partly also to their having written down stocks to the extent of £7,000. Debtors and sundry other accounts were represented by the sum of £121,375, as against £205,148. This decrease was consequent upon the smaller volume of business, and should be looked at in conjunction with the item of creditors on the other side of the balance-sheet. The cost of making the new issue of £100,000 prior lien debenture stock was £20,234, and, of course, they were not able to write anything off this amount this year in view of the loss shown. With regard to the securities which were represented by the sum of £99,585, it was unfortunate that, taking them in bulk, there had been some depreciation, but he might say that certain of the shares they held had appreciated, and they were confident that others of their holdings must appreciate in price as soon as things took a turn for the better. On the other side of the balance-sheet they would notice that the capital account showed the new issue of £100,000 5 per cent. prior lien debenture stock, but they had got rid of the old item of "loans and overdraft from bankers." In sympathy with the decreased turnover, the company's creditors at the end of the year stood at the small amount of £48,729. Speaking generally, he might say that in issuing the balance-sheet they had not attempted to gloss over the position. They had passed through a very bad period, and after applying the reserve of £10,229 towards writing off the year's loss, there was still a debit balance of £29,128 to get rid of out of future profits. He believed, however, that this was quite within their powers, and a single good year of revived trade would put them straight again. The aggregate of orders so far booked this year showed a satisfactory increase over that for the corresponding period of last year, and they were hoping that this improvement would continue. The contracts they handled, however, took time to execute, and as they entered the year with only a small amount of work in progress, the first few months had naturally been lean from the point of view of output. There would be an improvement in this respect from now onward, provided the volume of business did not again fall away. The increasing effects of restrictive legislation upon their home trade had during the past few years led them to devote a larger proportion of their attention to securing business abroad, and the principal orders now in hand were for export. When it became evident last year that their returns must suffer seriously from the depression of trade, they took steps to reduce staffs and to economise in every direction. It was impossible, however, in a business like theirs, to keep their establishment expenses at an exact ratio with the volume of work that was being done, or even to ensure that economies shall keep step with the state of trade that prompted them. There was, in fact, a certain minimum, below which their establishment expenses could not be reduced so long as their works and contracting departments were kept open. Some of the economies effected were only partially felt in 1908, and their general charges for the present year already showed a large further reduction. In conclusion, he might say that they were neglecting no opening to secure remunerative work. The keenness of competition and shortage of orders for their standard lines of manufacture had led them to investigate and develop along certain special branches of electrical industry which they hoped might prove to be valuable. One of those consisted in the conversion of exhaust or waste steam into electric power. Many owners of large works, collieries, &c., were now alive to the fact that exhaust steam which had for many years gone to waste, could by means of specially constructed steam turbines be turned into useful power. Instances were common where exhaust steam turbines of 500/750 H.P. could be operated in this way, thus amply justifying the capital cost involved. He was glad to be able to report that they had lately met with substantial success in securing contracts of this class, and it was their intention to energetically exploit this field and the other special branches to which he had alluded.

Mr. W. L. Madgen seconded the motion.

Mr. Cathcart said he was prepared for a bad report, but he must say he did not expect to receive such a disastrous one as that which the directors had presented. There did not seem a single redeeming feature about it. The company seemed to have gone from bad to worse, and it was evident that they could not go on losing £40,000 a year witout getting into serious trouble. In his opinion, the only way in which the company could be kept going was by drastic reduction of expenses, and also in seeing that no work was undertaken unless at remunerative rates. The bane of the company had been that they were content to take orders which yielded no profit.

Mr. Marchmont said he agreed with the remarks of the previous speaker, and he would like to propose an adjournment of the meeting for three months and the appointment of a small committee to confer with the directors. It seemed to him that they were now at the turning of the waters, and they must face the situation. As far as he could see there was very little between the company and liquidation, and nothing short of a miracle could save it.

The Chairman said he was afraid that a conference between shareholders and the board would not eventuate in more business, which was what the company wanted more than anything else. As he said, they had already done more business up to date than they did at the corresponding period last year, and it was only more business and better profits, coupled with a reduction in expenditure, which would save them. He admitted that the shareholders had been very forbearing, and that it was very trying for them not to see the improvement in business which they all hoped for. If new tramway enterprises were started, the probability was that they would get a fair proportion of the work in the future as they had in the past. At the present moment all they could do was to keep their expenditure down to the lowest possible limits.

Mr. Marchmont's proposition not being seconded, it fell to the ground, and the report was adopted.

Craigpark Electric Cable Co.

At the annual general meeting held in Glasgow, Mr. James T. Tullis, Chairman, in moving the adoption of the report, said that considering the general depression of trade during the past year the directors were confident that the shareholders would be satisfied with the account. Under the circumstances the profit for the year was satisfactory, and the directors were pleased to be able to recommend a dividend of 6 per cent. on the ordinary shares in addition to the 6 per cent. on the preference shares. An increased output had been obtained in cables, but this had entailed increased wages and general expenditure. The managing director had, however, now further organised the different departments in such a way that further increased output, which was reasonably expected this year, would not involve any material increase in general expenses. The machinery for the manufacture of the different classes of cables was in good working order and capable of a large increase in trade, and while the results last year were not apparently so good financially, the volume of business was much greater than in any previous year. Their manufactures now included every class of cable required in the electrical industry, including bitumen, gutta-percha, india-rubber, and paper. This covered a very wide field for a company such as theirs, and naturally the development of the business absorbed a lot of money. The directors considered that at this stage of the life of the company, the development of the business on a broad basis was more important for future benefits than the earning of big dividends, and they ought to congratulate themselves upon the success that had so far attended their operations.

Seconded by Mr. W. S. Browne, the report was adopted. Dr. Magnus Maclean and Mr. W. R. Dick were re-elected directors.

Stock Exchange Notices. — The Committee have appointed a special settling day as under:—

Friday, June 4th.—Mexico Tramways Co.—Scrip, fully paid, for £1,250,000 6 per cent. 50-year mortgage bonds.

And ordered the undermentioned securities to be quoted in the Official List:—

Johnson & Phillips, Ltd.—£157,455 5 per cent. first mortgage debenture stock.

Mexico Tramways Co.—Scrip, fully paid, for £1,250,000 6 per cent. 50-year mortgage bonds.

P.P.K. (Ceylon) Rubber Estates, Ltd.—65,000 shares of £1 each, fully paid, Nos. 1 to 65,000.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Winnipeg Electric Railway Co.—Scrip, fully and partly paid, for £300,000 4½ per cent. perpetual consolidated debenture stock.

And to allow the following securities to be quoted in the Official List:—

Mexico Tramways Co.—Further issue of $4,823,200 Common stock in shares of $100 each.

Thames Ironworks, Shipbuilding and Engineering Co.—At the meeting of this company, the chairman (Mr. A. M. Alexander) said that the depression of trade had been very widespread, and this, with a continued absence of Admiralty orders, had been the cause of the unsuccessful results of the company's operations. The electrical department had done its share of work in connection with the Walton-on-Thames pumping station, and, besides orders for work of various kinds for the London County Council Tramway Department and other public authorities, they had supplied a large number of electric switches.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors report a profit of £21,644 for 1908. After providing debenture interest and dividends on preference and ordinary shares, and placing £7,500 to reserve for depreciation and renewals, £1,226 is carried forward. The total balance to credit of profit and loss account is £6,556. Since the date, to which the accounts have been made up, a dividend has been declared and paid at the rate of 6 per cent. per annum on the preference shares for the six months ended March 31st, 1909, and the directors recommend a dividend at the rate of 3 per cent. per annum for the six months ended December 31st, 1908, on the ordinary shares, making 4 per cent. for the year.

Castner-Kellner Alkali Co., Ltd.—The directors announce an interim dividend at the rate of 10 per cent. per annum for the six months ended March 31st.

Oldham, Ashton and Hyde Electric Tramways, Ltd.—The directors have declared a final dividend of 7 per cent., making a total distribution of 6 per cent. for the year.

West African Telegraph Co., Ltd.

The twenty-fourth ordinary general meeting of the shareholders of this company was held on Wednesday last week, at Electra House, Finsbury Pavement.

The Marquis of Tweeddale in the chair, in proposing the adoption of the report (Electrical Review, May 7th, page 772), said that their proportion of the receipts from the South African joint purse continued to decline, and was this year £990 less than in the preceding year. He was, however, pleased to be able to state that the current year, as far as it had gone, showed indications of an improvement in this branch of their revenue. The Portuguese traffic showed an increase of £1,160 over 1907, and the interest on the reserve fund investments amounted to £1,000 more. The diminution in the receipts was in the main due to the exchange, which had adversely affected the revenue to the extent of £3,900. Fluctuations in the rate of exchange had marked the progress of the company from the beginning. Only two years ago he was able to report a profit on exchange of £1,000, and they hoped soon to return to better times. As regarded the expenditure, although the working expenses at stations showed an increase in 1907 of £700, the total working expenses were £945 less, owing to a decrease of £1,700 in the expenses attending the maintenance of cables, which might be considered a satisfactory feature. He mentioned last year that the total cost of renewal of the St. Thome-Loanda section of their cable had not then been ascertained. He was now able to inform them that the actual sum expended was £10,899, the final figure of £2,274 appearing this year as a charge against the general reserve fund. More suitable quarters for their staff had been erected at Bolama, the estimated cost of which would be about £1,700, and that also would be charged against the general reserve fund.

Sir J. Denison Pender, K.C.M.G., seconded the motion, and the report was adopted.

Potteries Electric Traction Co., Ltd.

The meeting of this company was held on Friday at the Electrical Federation Offices, Kingsway, Mr. G. F. N. Cornwallis-West presiding.

In moving the adoption of the report (Electrical Review, May 14th, page 817), the Chairman said it was with regret that, for the first time since its existence, the board recommended that the ordinary dividend should be passed. He, however, felt convinced that, when they had heard his explanation, they would agree with the directors that the course they had adopted was a wise one and in the interests of the company. That a distribution out of the current year's revenue was possible was obvious from the accounts. During the year the company had suffered a serious decline in its receipts, due practically entirely to the terrible state of trade in the district served by the tramways. As they were aware, that general depression had existed throughout the country, but he might say, without exaggeration, that nowhere was it worse than in the Pottery districts. Some of the mills were closed entirely, and others were working on half time or less. Although they had been able to reduce their working expenses, there had been increases under one or two heads. They had spent a considerable sum of money in maintaining the permanent way and the rolling stock and in the renewal of lines. The decrease in the traffic receipts was over £3,000, and they were the lowest they had obtained since the completion of the system as at present constructed. As an illustration of the state of trade in the district, he might mention that they had carried 936,700 fewer workpeople than in 1907. At the present moment there did not appear to be any great revival in the trade of the district. Probably the pottery industry suffered more than any other from foreign competition, or certainly as much as any manufacturing industry in the country, and when trade throughout the world was suffering from general depression, unlike foreign importers to this country, they were unable to export any other produce at a profit by reason of the high tariff walls which they were met with on all sides. Repairs, maintenance, and renewals had cost them £22,752. In 1906 the expenditure under that head was £17,700, and in 1907 £25,700. In 1906 a suspense account was opened for dealing with the renewals of the permanent way. During the past three years £11,400 had been dealt with through that account. They were now entering the fourth year of existence of that account, and there was still a balance in suspense of £5,409, and further renewals were contemplated this year. The estimated amount they would have to spend in the current year was £5,967 in repairs, £5,297 on renewals, and £1,522 on capital. They therefore proposed not only to extinguish the suspense account entirely, but also to carry forward a credit balance of £2,000 in order to deal with this amount, and in addition there would be a sum available out of this year's receipts. He did not think anyone could question the soundness of that policy. It would have been possible to take the amount from the reserve and depreciation account, but he had always maintained, and the other directors agreed with him, that it was never intended to deplete that fund, but as far as possible to add to it from time to time. It must be clearly understood that as long as they put such large sums to general renewals fund, it would be impossible to add equally large amounts to the general reserve. There was no doubt that the financial position of the company would be greatly strengthened by the adoption of the board's proposal. He had before referred to the difficulty of carrying on the finance of the company with economy, as they were precluded from issuing shares at a discount, and until further shares were issued they could not, under the articles, issue more debenture stock. That was why they had an overdraft at their bankers of £30,000. The bank had agreed to continue this loan on the security of their North Staffordshire debentures. The effect of the policy of the board, as far as this year's accounts were concerned, should result in this overdraft being considerably reduced. He was glad to say that the parcels traffic showed a considerable development, the actual increase in the receipts last year being £191. On the expenditure side power and running showed an increase of £700, entirely due to the increased cost of coal. The contract which they had entered into this year would show a considerable reduction in price. The running expenses apart from power showed a decrease of nearly £1,500. That had been brought about by the lessened service owing to the decrease in the travelling public; but a very much greater proportion of the economy had been the result of the improvements and the duplicating of the permanent way, which had enabled them to run the same service as in former years with fewer cars. The administration and general expenses showed a satisactory decrease, the only item where there was an increase being rates and taxes. They had appealed against the assessment and had got it reduced. There was also a decrease in insurance which had been brought about by a decrease in the levy on their third party risks in consequence of their immunity from accidents. As they knew, the associated companies had an insurance fund of their own; there were eight classes of risks, and they came in the lowest class. The capital expenditure during the year had amounted to £4,930. He might say in conclusion that the directors considered the passing of the ordinary dividend to be only a temporary set-back to the prosperity of the company. They could hardly call it a set-back, as he believed it to be in the best interests of the company, and that it would be in a much stronger financial position owing to the action which they had taken.

Sir Thomas Pilkington seconded the motion, and the report was adopted.

Eastern Telegraph Co., Ltd.

The meeting of this company was held on Wednesday last week at Electra House, Finsbury Pavement, Sir J. Wolfe Barry presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, May 7th, page 772), said the gross revenue for the half-year amounted to £566,100, against, for the corresponding period of 1907, £595,400, or a reduction of £29,300. This falling-off in the receipts extended over nearly every branch of the traffic. The principal reduction, however, was in the Egyptian traffic, which alone showed a decline of £11,000 when compared with the half-year to December, 1907, and was largely due to the cotton strike in Lancashire, this factor also being the principal cause of the falling-off of £5,000 in the receipts from traffic with India. On the other hand, he was pleased to record an increase of about £5,000 in receipts from messages exchanged with South Africa and Turkey. They hoped that the improvement in South African traffic was an indication of the revival of trade in that country which had been so anxiously expected ever since the termination of the war, and he trusted that the gradual development which was evidently taking place at the present time would prove to be of a permanent nature, and that the revenue from this source would again be maintained at a figure approaching the "Standard Revenue" of £300,000. The total amount of this revenue for the year 1908 was only £235,000. The increase in the Turkish traffic was due to the political changes which had lately been taking place in that country. He was pleased to say that the current year, so far as they had gone, showed an improvement in revenue over 1908. Turning to the expenditure, the working expenses amounted in round figures to £253,600, against for the half-year ended December, 1907, £261,700, or a decrease of £8,100. The working expenses at stations were £3,600 more than they were for the corresponding half-year, maintenance of instruments alone showing an increase of £1,200, largely due to the introduction of improved apparatus at some of the more important stations. The expenditure in respect of maintenance of cables showed a satisfactory decrease of £11,400. In view of the importance of continuing to make substantial contributions to the general reserve fund, they had not on this occasion added to the maintenance ships' fund, especially as that fund had now reached a considerable sum. They were, therefore, able to carry the same amount to general reserve fund as they did in the corresponding half-year of 1907. It was only to be expected that the general depression which had existed for some time past in the trade of the world would, to some considerable extent, reflect upon the traffic receipts of the company. Their experience in the past had shown that no surer signs of the rise and fall of the commercial barometer could be found than in the study of the variations of the traffic receipts of submarine cable companies, and perhaps this was more marked in the case of that company, whose revenues were derived from so many of the trade centres of the world. Although they had suffered in common with almost every other commercial undertaking, he was glad to say that they had been able to maintain the payment of the usual dividend and bonus on the ordinary stock, and make a substantial contribution to the general reserve fund, but the result of the working for the whole year ended December 31st, 1908, showed that they had carried £20,000 less to that fund, and £7,000 less to the maintainance ships' fund than they did in the year ended December 31st, 1907. Had they not anticipated the loss of revenue which they foresaw was likely to occur during the year 1908, and provided for it by carrying forward from the 1907 accounts a balance of nearly £35,000 more than usual, the total contribution to the general reserve fund for 1908 would have compared still more unfavourably with the preceding year. On

July 1st next the alterations in the rules and regulations of the International Telegraph Convention, approved by the Lisbon Conference of 1908, came into operation. There was very little in the alterations that affected this company, but he might perhaps call attention to an existing anomaly in counting official code words which this company was anxious to abolish. The regulations allowed any pronounceable combination up to 10 letters to be accepted, but combinations composed of *bond fide* words were excepted. "Abobarbate" is accepted as a legitimate combination, but "Canyoucome," whether used as plain language or joined together as a code word, was charged as three words. This regulation had given rise to many disputes between their customers and themselves, and the companies expressed their willingness to accept any combination in artificial language that could be pronounced, whether composed of groups of plain language words or purely artificial. The companies' position, which, no doubt, would have been a convenience and saving to the public, was fully discussed at the Conference, and although the Governments recognised that the companies were right in principle, they were, owing to financial reasons, forced to refuse the suggested alteration. A large proportion of the European correspondence passing over the landlines or cables owned by the European Governments consisted of plain language messages, and if the alteration in the rule had been passed the public would have been able to join any plain language message together and divide the total number of letters by 10 and so arrive at the number of paying words, but the estimated loss of revenue to the European Governments would, in consequence, have been so large that the representatives of the Governments felt that the companies' propositions could not be accepted. Owing to the companies' ordinary traffic being composed almost entirely of code language of about 10 letters, their revenues would not have been materially affected by such alteration.

Sir John Denison Pender seconded the motion, and it was agreed to.

Western Telegraph Co., Ltd.

The meeting of this company was held on Wednesday last week at Electra House.

Sir J. Wolfe Barry, K.C.B., in moving the adoption of the report (see Electrical Review, May 7th, page 792), said the remarks he made at the last meeting had, perhaps, prepared them to expect a decrease in the traffic revenue for the last six months of 1908. He was glad to say that the reduction was not so great as was at one time expected, some improvement being manifested during the last few weeks of the year. The message receipts, however, showed a falling off of £13,624; and rents, interest on deposits, &c., were less by £383; making together £14,007. This was reducible by an increase in the interest received on investments amounting to £3,860; making a net decrease of £10,147. On the other side of the account the general expenses, maintenance of cables and income-tax were more by £8,007; the result being that the net earnings were less by a little over £18,000. The decrease in message receipts occurred in Brazil, the River Plate and on the West Coast of South America, but more especially in the last-named district. The general expenses in London showed an increase of £295, and those at the stations a net increase of £3,994, the gross increase in expenses amounting to £6,059. The expenses incurred in connection with improved apparatus, and the further installation of automatic and relay instruments caused an additional cost of over £1,500, while the cable used in the maintenance of their submarine lines accounted for an increase of nearly £1,000. After providing £16,000 for debenture stock interest and £5,661 for income-tax, there remained a balance of £188,333, plus £4,259 brought forward, making a total of £192,593. First and second interim dividends, amounting to £62,379, had been paid, and, after transferring £100,000 to the general reserve fund, £5,000 to the maintenance ships' reserve fund, £10,000 to the marine insurance fund, and £10,000 to the land and buildings depreciation fund, there remained a balance of £5,214, which was carried forward to the next account. A reduction of the tariff with the west coast of South America was made on 1st inst. Negotiations were at present proceeding on their behalf with the Brazilian and Argentine Governments with regard to improved submarine telegraphic communications, but he was not yet in a position to enter into details on the matter. The tendency to growth in the cost of conducting the business of submarine telegraphy was noticeable, and, in spite of their efforts in the direction of economy, again appeared in their accounts. The facts were that to obtain a really efficient service, which theirs admittedly was, they must keep abreast of the time, both in improved apparatus, constant repairs and additions to their cables, and also in maintaining a highly-trained and skilled staff. By those means they maintained their position in the face of competition at some of their most important centres, and, he ventured to think, had secured the confidence of their clients and of the Governments of the countries with which they were connected.

Sir J. Denison Pender seconded the motion, which was unanimously agreed to.

Demerara Electric Co.—In the *Demerara Argosy* of April 16th is published an ordinance consenting to the reduction of this company's capital from $850,000 to $425,000. The necessity of adding anything to the company's name to denote the reduction has been dispensed with.

Belgium.—The Bell Telephone Manufacturing Co., of Antwerp, reports a profit of £16,445 for the last financial year.

Calcutta Electric Supply Corporation, Ltd.

In their report the directors first express regret at the death of the chairman, Colonel A. J. Filgate, R.E. They then congratulate the shareholders on the continued prosperity and progress of the company. During the past year 6,765,792 units were sold, an increase of 23 per cent. over the sales in 1907. The number of houses connected shows an increase of 675, and the equivalent connections in 8-c.p. lamps an increase of 57,972. Notwithstanding that from January 1st, 1908, the price of current for power purposes was reduced 25 per cent., the total gross revenue of the company has increased by nearly £12,000. The costs, however (largely due to the high price of coal) have also increased by £11,014. An abnormal outlay has had to be incurred in repairs, particularly to the engines and boilers at the company's Emambagh Lane station, and the amount of the cost, in excess of the average, has been charged to the renewals fund. The sum of £60,221 has been expended during the year on capital account, chiefly on extensions of mains, additions to machinery and meters. The demand for electricity in Calcutta is increasing in a remarkable manner, and as the area covered by the operations of the company is very large it is certain that further capital will be required in the near future. At the same time it is satisfactory to note that, although the annual outlay on capital account has always been a large item, the percentage of gross and net earnings has steadily and satisfactorily risen, a fact which fully justifies the increased expenditure. The following figures show the comparative results of the past four years:—

Year.	Houses.	Equiv. 8-c.p.	Units sold.	Gross revenue.	Net revenue.
1905 ..	2,451	215,018	3,548,229	£72,591	£43,242
1906 ..	3,060	262,893	4,578,380	£89,242	£50,176
1907 ..	3,721	320,863	5,487,883	£103,360	£57,276
1908 ..	4,396	378,835	6,765,792	£115,287	£58,188

Exchange is calculated at 1s. 4d. per rupee.

The net profits for the year 1908 amount to £58,188 (compared with £57,276 in the previous year) to which has to be added the balance brought forward from 1907, £4,161, and after deducting the interim dividend, at the rate of 6½ per cent. per annum, paid in November, 1908, on the ordinary shares, and the dividend paid and accrued on the preference shares, together with the other items set out in the net revenue account, there remains an available surplus of £41,669. The directors recommend that £15,000 be placed out of profits to the credit of the depreciation and renewals account, and that a final dividend for the second half-year, at the rate of 9½ per cent. per annum, be paid on the ordinary shares (making 8 per cent. for the year), which will leave a balance of £3,304 to be carried forward, after providing for the directors' extra remuneration of £1,000. Mr. J. G. H. Glass, C.I.E., has retired from the board. Mr. A. M. H. Walrond and Colonel F. J. G. Murray have been elected to fill the vacancies on the board.

Callender's Cable and Construction Co., Ltd.

The directors' report for the year ending December 31st, 1908, shows a balance at the credit of profit and loss account for the year's working of £61,614 plus £45,107 brought forward, making together £106,722. From this is deducted interest on debenture stock, £13,500; dividend on preference shares, £10,000; appropriation for depreciation of buildings, plant and machinery, £11,087, leaving an available balance of £72,135, which it is proposed to deal with in the following manner:—By the payment of a dividend on the ordinary shares at the rate of 10 per cent. per annum (less income-tax), being 10s. per share, whereof 5s. was paid on November 1st, 1908, and 5s. will be paid on May 29th, 1909 (less income-tax), £17,500; by the payment of a bonus of 5s. per share, to be paid also on May 29th, 1909 (less income-tax), £8,750; carrying forward to next year's account £45,885. In view of the additional burdens proposed to be placed on income, the directors have thought it expedient to alter the principle on which dividends have hitherto been calculated, and they therefore propose that for the future all dividends and bonuses shall be paid subject to the deduction therefrom of the income-tax. Considering the extremely unfavourable conditions which prevailed during the whole of 1908, the directors consider that there is every reason to be satisfied with the results of the year's operations. The deplorable condition of the engineering trade during the past twelve months in every part of the world is too well known to need more than passing reference. It has, however, resulted in the business secured by the company being restricted both at home and abroad. No new undertaking of any importance in the electrical industry was carried into effect during the period under review, the orders secured by the company being confined almost exclusively to extensions of networks and supply stations already in existence. The advent of the metal-filament lamp had the temporary effect of reducing the volume of cable orders, but the directors have no misgivings on this account, being convinced that this development will so benefit the industry in the near future that it must largely increase the company's operations. The uncertainty as to the action of Parliament in regard to the electric supply of London has also been a factor in limiting cable-work, as until the passing of the recent Act regulating supply in the metropolis, all extensions there were practically at a standstill. A fair trade was, however, done in rubber wires and cables, and the board has every reason to be satisfied with the operations of the Anchor Cable Co., Ltd. The extensions of the business in the Colonies and abroad has received the constant consideration of the board, and taking into account the paucity of orders on the market, and the general adverse conditions prevailing, they consider that the company has secured a very fair proportion of the contracts

available. The operations of the German company have tended materially to assist business in that country, and elsewhere in Europe, although the electrical trade on the Continent has also suffered from depression and from unusually severe competition. The factories at Erith and Leigh have, on the whole, been fairly well occupied during the year, and are so now, but their capacity in both cases is largely in excess of the existing demand. The machinery, plant, and appliances at the factories at Erith and Leigh, and on outside contracts, have been maintained in a thoroughly efficient condition, and the cost of so doing has, as usual, been charged against the year's accounts. Considerable expenditure has been incurred on the erection of a new testing station at the Erith factory, to meet the ever increasing requirements of the various Government Departments, and of the industry.

Lisbon Electric Tramways, Ltd.

Sir Charles Euan Smith, K.C.B., at the meeting held on Wednesday last week at London Wall Buildings, referred to the continued prosperity of the business. The political situation had continued unfavourable in the past year, and consequently the general commercial situation had suffered. Still, their traffic showed a slight increase, which must be considered under the circumstances a very satisfactory result. They had carried 45,999,432 passengers, earning Rs. 1,499,318, as against 45,532,062 passengers earning Rs. 1,472,778 in 1907. A serious depreciation in the rate of exchange had, however, made a difference of £12,000 sterling to them, and consequently they were only able to carry forward after the declaration of the dividend a balance of profit of £4,640, as against £13,271 in the preceding year. This constant fluctuation in the value of the Portuguese currency, which could not be avoided, justified the wisdom of setting aside a considerable sum yearly as an exchange reserve. This reserve, to which they again added £5,000, had now reached £25,000, and it was the intention of the board to bring it up to a total of £50,000, which sum they considered necessary, and which they trusted would be sufficient to secure for them a uniform rate independent of all variation. The exchange had lately shown more firmness, which was a good indication of the gradual development of stability both in politics and business. On the advice of their manager and engineers, and with the express approval of the auditors, they had transferred the balance standing to their depreciation reserve account as at the end of 1907 to the credit of the capital expenditure account, which represented as nearly as possible the actual value of wear and tear on their tramways at that date. They had again placed £35,000 to the depreciation reserve account for the year 1908. They believed that their investment in the Nova Campanhia Dos Ascensores Mechanicos de Lisbon would prove remunerative, and the board were thoroughly satisfied that the working of this line would prove a valuable supplement to the general system, and most materially contribute to the public benefit. The course of politics in Lisbon had resulted in a complete change in the composition of the Municipal Council, and for the first time since they began, their relations with that body were not as cordial as they would wish. Their earnest endeavour now, as ever, was to work harmoniously with the authorities, having due regard to the interests of the shareholders, and also to maintain the tramway service second to none in Europe; and they were confident that their successful efforts in that direction were appreciated by the general public of Lisbon, especially as the policy of the board always contemplated the extension to the public of any privileges which might prove to be possible. The company was continuing its conservative and prudent policy to maintain a strong financial position. The board now recommended the payment of 5 per cent. on the ordinary shares.

Mr. Ludwig Breitmeyer seconded the motion, and the report was adopted without discussion.

The retiring directors were re-elected, and 1,200 guineas was voted to the board as their remuneration.

Diesel Engine Co., Ltd.

The directors recommend that a dividend of 10 per cent., free of income-tax, be paid on both the ordinary and preference shares for the year ending March 31st, 1909. The credit balance of profit and loss account is £15,356, to which has to be added £5,919 brought forward, making a total of £21,276. £10,001 will be required to pay the proposed dividend of 10 per cent, and the directors suggest placing £5,000 of the balance to the general reserve account, thus increasing this reserve to £15,000, and carrying forward £6,275. Owing to the general depression in trade, orders, during the past year, have been more difficult to obtain, and the directors are, therefore, of the opinion that, under these circumstances, the accounts may be considered most satisfactory. Since the last ordinary general meeting, the litigation in which the company was involved with the International Power Co. of New York, has been brought to a satisfactory conclusion, and the suspension account in connection with this matter has consequently been removed from the balance-sheet.

France.—The balance sheet of the Société d'Energie Electrique du Littoral Mediterranéen reports a profit of £41,994 for the last financial year, as contrasted with £47,582 in the preceding 12 months.

British Westinghouse Electric and Manufacturing Co., Ltd.

The ninth annual report for the year ending December 31st, 1908, states that the results for the 12 months have been affected by the serious depression in trade and by the severe competition for the reduced volume of business which has been offering. The trading, &c., profits amount to £64,772, from which fall to be deducted—expenses on surplus land and buildings £4,471, interest on 6 per cent. prior lien debentures (part of year) £7,526, interest on temporary loans £1,885, interest on 4 per cent. mortgage debenture stock £49,654, leaving a balance of £1,236, which, together with the balance brought forward from last year amounting to £11,341 has been more than counterbalanced by the appropriation required for the prior lien redemption fund, and other special expenditure set out in the profit and loss account, leaving a debit balance to be carried forward of £6,521. The financial position of the company will be seen to have considerably improved since the last report. Loans from bankers and the American Westinghouse Co. have disappeared, sundry creditors are reduced from £145,240 to £103,782, while on the other side, sundry debtors and completed work on contracts show but a small decrease of £5,222, cash at bankers and in hand showing an increase of £156,829 available for extension of business. The falling off in the volume of business carried out during the year under review has been chiefly in the home markets, export business having maintained about the same volume as last year. A substantial sum having been expended out of revenue during the year for the maintenance of buildings, machinery and plant, the directors do not deem it necessary to provide for further depreciation in this year's accounts. A comparison of the past year with the three preceding years shows the turnover to have been about the same. The total expenditures for factory, operating, selling and administration expenses, have declined by some 20 per cent. as compared with 1905 and 1906, and 10 per cent. as compared with 1907, in which year these expenses has already fallen some £30,000. Orders to date slightly exceed those for the corresponding period of last year. There is some appearance of a revival in trade, and it is to be hoped that the remainder of the year will show an improvement in the volume of business. Mr. E. Goulding, M.P., and Mr. A. P. Livesey have been elected to vacancies on the board, and the shareholders will be asked to confirm these appointments at the meeting on Monday next. Mr. J. H. Lukach has retired from the board.

Johnson & Phillips, Ltd.

The directors report that for the year ending December 31st, 1908, the profit on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £3,427 for maintenance of buildings, plant, &c., amounts to £10,037, plus balance brought forward from 1907, £6,873, making £16,911. From this there is deducted depreciation on buildings, plant, &c., £2,000; remuneration of directors, auditors' and trustees' fees, £1,560; interest on debenture stock to December 31st, 1908, £8,139; reserve *re* debenture sinking fund, £4,530; carrying forward to next account, £681. The directors regret to report a considerable falling off in the profits for the year owing to the low prices ruling in the electrical trade, and also the general depression in trade and natural decrease in the business done. The cable business, however, has been fairly well maintained, and shows signs of a decided improvement, which is considered highly satisfactory forming as it does the major part of the business. The outlook is, therefore, promising, and the directors have every confidence in the good prospects for the ensuing year.

Rangoon Electric Tramway and Supply Co., Ltd.—The third general meeting was held on May 18th in the Common Hall, Hackins Hey, Liverpool. Mr. Frank Tobin, in moving the adoption of the report and accounts, said that the capital during the past year had been increased by the issue of 10,000 £5 preference shares. Since the company was formed preference shares to the value of £100,000 and ordinary shares to the value of £25,000 had been issued, and of that £60,000 had been expended in laying underground cables instead of overhead wires, as required by the Rangoon authorities, £25,000 in providing stores in Rangoon, and £20,000 in fitting up a new turbine, boilers, &c.; while the rest of the new capital had gone in ordinary expenses of the business. During the ensuing 12 months the capital requirements would be on the same scale as previously. The balance-sheet showed that they had earned the dividend on the preference shares in addition to paying interest on the debenture stock. Nothing, however, had been earned for the ordinary shareholders. Still they felt they had turned the corner, and the present year's results would be better. The tramways had proved fairly satisfactory, the takings, which had been affected owing to the monsoon being of exceptional duration, totalling just under £50,000. The expenses had been 60 per cent., which included 10 per cent. spent on maintenance, and it was hoped to get the percentage down to 50 on the current year. The public lighting department was satisfactory, and the supply of light and power to private customers was a promising branch. Mr. James Taylor seconded the motion, which was carried.

Italy.—La Societa d'Elettricita della Sicile Orientale is increasing its capital from £160,000 to £200,000. The headquarters of the concern are also being removed from Rome to Milan.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	May 12	2,647 — 35		50	67,319 — 33		..	..
Ayr	,, 15	467 + 1		52	14,429 — 311		8	..
Bath	,, 12	1,504 + 33		19	12,264 + 464		..	..
Belfast	,, 14	7,593 + 355		6	24,132 + 777		37	..
Birkenhead	,, 16	2,118 — 50		6	6,866 — 228		13·52	..
Birmingham Corp.	,, 8	12,884 — 370		6	36,147 + 435		..	..
Blackpool-Fleetw'd	,, 15	798 + 24		19	6,801 + 658		..	..
Bolton	,, 9	4,715 + 110		6	13,823 + 14		26	..
Bournemouth	,, 12	3,097 + 105		6	10,392 + 127		21·96	..
Bradford	,, 8	9,366 + 407		6	26,891 + 744		54·9	..
Brighton	,, 16	4,714 + 165		7	6,018 + 573		9·5	..
Bristol	,, 14	10,558 + 850		..	.. ..		..	..
Brit. Elec. Trac. Co.								
Airdrie	,, 7	428 — 3		18	3,855 — 72		3·65	..
Barnsley	,, 7	397 + 12		,,	2,962 — 71		..	..
Barrow	,, 7	418 — 12		,,	3,716 — 276		5·37	..
Cavehill	,, 7	149 + 2		,,	1,183 — 165		..	..
Devonport	,, 7	710 — 216		,,	6,605 — 330		8·85	..
Gateshead	,, 7	1,926 + 61		,,	17,550 — 103		11·25	..
Gravesend	,, 7	388 + 8		,,	3,300 — 122		6·5	..
Greenock	,, 7	1,097 + 84		,,	8,520 — 92		7·25	..
Hartlepool	,, 7	414 — 39		,,	3,631 — 116		6·72	..
Kidderminster	,, 7	175 ..		,,	1,526 — 57		..	..
Leamington	,, 7	309 + 16		,,	2,662 + 180		..	..
Merthyr	,, 7	391 — 11		,,	3,659 — 3		2·9	..
Metropolitan	,, 7	12,319 —1,854		,,	100,586 +11,673		22	..
Middleton	,, 7	643 + 4		,,	5,536 — 240		8·5	..
Mid. Joint Com'tee	,, 7	10,240 — 172		,,	93,816 — 2,226		..	..
Oldham—Ashton	,, 7	1,085 — 26		,,	9,722 — 660		9·13	..
Peterborough	,, 7	216 — 4		,,	1,840 — 105		5·31	..
Potteries	,, 7	3,521 + 49		,,	31,349 — 1,118		29	..
Rothesay	,, 7	217 ..		,,	1,871 — 17		2·75	..
Southport	,, 7	516 + 14		,,	4,274 + 118		8·17	..
S. Metropolitan	,, 7	1,528 + 43		,,	12,599 + 860		..	..
Swansea	,, 7	1,776 + 1		,,	15,875 — 350		13·5	..
Tynemouth	,, 7	337 + 28		,,	2,581 — 79		3·75	..
Weston-s-Mare	,, 7	166 + 9		,,	894 + 104		3	..
‡Worcester	,, 7	540 + 5		,,	4,371 + 1		5·75	..
Wrexham	,, 7	186 — 3		,,	1,666 — 47		..	..
Yorks. Wool. Dist.	,, 7	1,756 + 24		,,	15,321 — 470		17	..
Miscellaneous	,, 7	387 + 30		,,	3,329 + 12		..	..
Burnley	,, 15	2,497 + 53		..	.. ..		..	..
Burton-on-Trent	,, 16	492 — 42		7	1,717 — 25		10	..
Bury	,, 16	2,354 — 65		6½	8,020 — 99		22·5	..
Cardiff	,, 8	4,162 — 47		6	11,840 — 13		..	..
Carlisle	,, 15	307 — 31		19	2,879 — 47		..	..
Chatham and Dist.	,, 13	1,577 — 25		19	13,941 + 1,293		14·98	2·77
‖Cork	.. ..	.. ..		..	.. ..		..	..
†Croydon	,, 7	1,401 + 6		..	8,001 + 530		11·25	4·75
Darlington	,, 15	358 — 41		7	1,276 — 90		..	..
Darwen	,, 14	496 — 42		6	1,612 — 64		4·36	..
Dover	,, 8	356 — 8		6	1,064 + 4		4·75	..
Dublin	,, 14	10,582 + 55		..	94,615 + 1,121		54·25	..
Dundee	,, 12	2,323 — 80		52	61,801 + 2,025		15	..
East Ham	,, 15	1,996 + 363		6½	6,527 + 1,193		8·43	·68
Exeter	April 30	595 — 69		5	1,405 + 85		5·5	..
Glasgow	May 15	35,585 + 441		..	848,471 —16,482		90·5	1·5
†Hastings	,, 13	925 + 43		..	.. ..		..	..
†Huddersfield	,, 8	1,686 + 142		5	9,271 + 498		..	..
Hull	,, 15	4,711 — 107		6	16,114 + 4		13	..
Ilkeston	,, 12	239 — 55		6	781 — 49		..	..
†Ipswich	,, 15	671 — 54		7	2,379 + 111		10·5	..
Kilmarnock	,, 8	300 + 5		51	7,428 — 354		4·25	..
Lan'kshire Trm.Co.	,, 13	2,457 — 95		19	22,733 — 1,416		17	1·18
Lancashire United	,, 12	2,588 — 1		19	23,536 + 321		..	..
†Leeds	,, 8	6,547 + 319		6	36,957 + 2,389		96·75	·25
Leicester	,, 15	4,363 — 194		..	.. ..		..	..
Leith	,, 8	1,086 + 28		51	26,443 + 99		6	..
Liverpool	,, 8	21,316 — 271		18⅔	190,433 — 820		104	..
‡L.C.C.	,, 1	71,293 +6,293		..	159,342 +16,910		121	4·25
London United	,, 15	12,307 — 909		..	102,346 — 5,424		..	..
Manchester	,, 15	29,572 — 74		7	97,375 + 2,371		90·5	6
Newcastle	,, 15	7,458 — 30		..	25,371 — 7		..	..
Newport	,, 15	1,243 — 2		7	4,523 + 30		14·5	..
Oldham	,, 16	3,718 — 221		7	14,627 — 641		23·75	..
Pontypridd	,, 15	803 + 173		6½	2,871 + 508		5·5	1·75
Portsmouth	.. ..	.. ..		..	.. ..		14·5	..
Preston	,, 12	1,442 — 37		..	.. ..		..	..
Rotherham	,, 13	1,170 — 14		6	3,788 — 44		10	·66
Salford	,, 10	8,949 — 243		55	26,818 + 53		..	..
Sheffield	,, 16	11,032 — 389		7⅔	41,460 — 438		37	1·25
Southampton	,, 12	1,955 — 148		6	6,122 + 208		..	..
Southend-on-Sea	,, 12	788 + 99		6	2,631 + 517		..	..
South Shields	,, 15	1,030 — 29		6⅔	3,501 + 141		..	..
†Swindon	,, 5	111 — 37		..	.. ..		..	..
Tyneside	,, 12	798 + 90		19	7,576 + 578		..	..
Wallasey	,, 8	1,783 + 110		£½	5,099 + 383		..	·22
Walthamstow	,, 15	1,259 + 54		7	4,300 + 548		9	..
West Ham	,, 6	2,542 + 482		5	12,207 + 1,279		15	·3
Wolverhampton	,, 12	1,527 — 152		6	4,805 — 260		12·5	..
Baker St.-Waterloo	,, 15	6,265 + 105		19	63,710 + 5,260		4·25	..
Cen. London Rly.	,, 15	10,810 —1,819		19	104,144 — 9,955		6 32	·55
Char. +, Eus. Hamp.	,, 15	7,780 +1,180		19	73,180 +12,455		7.75	..
City & S. Lon. Rly.	,, 16	5,998 — 21		19	62,299 + 423		7·3	..
†Dublin-Lucan Rly.	,, 14	279 + 36		19	2,217 + 180		7	..
G.N. and City Rly.	,, 15	2,854 — 319		19	29,170 — 3,586		8·5	..
G.N., P'y. & Brmtn.	,, 15	11,425 + 295		19	110,190 + 7,120		9·25	..
L'pool Overh'd Rly.	,, 16	2,605 — 217		19	25,906 — 1,855		6·8	4·3
Llandudno-Col. Bay	,, 7	205 + 102		23	3,092 + 1,162		..	..
Mersey Railway	,, 15	4,040 + 245		19	37,364 + 1,032		4·5	..
Metropolitan Rly.	,, 16	31,919 +1,027		19	299,698 + 8,876		24·5	..
Met. District Rly.	,, 15	19,871 +1,819		19	185,126 +16,450		24	..
Anglo-Argentine	,, 13	71,118 —6,014		19	749,646 +41,716		..	..
§Auckland	Mar. 26	13,656 +2,444		12	41,824 + 4,724		..	..
Bombay (B.E.T.)	April 15	5,181 + 159		15	38,562 + 2,656		..	..
§Brisbane	April	15,580 +1,070		..	.. ..		..	..
Calcutta	May 15	6,558 + 483		..	.. ..		..	..
§CapeElectricT.Ld.	March	13,179 ..		..	.. ..		..	..
§Kalgoorlie, W.A.	April	3,570 ..		17	14,876 ..		20·5	..
Madras	May 15	1,264 + 27		19	11,665 + 115		..	..
§Melbourne	April	47,000 ..		..	.. ..		..	..
§Lisbon	March	25,726 ..		..	.. ..		..	..
Perth (W.A.)	May 14	2,719 — 28		19	27,919 + 49		28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.
‖ Traffic suspended, owing to strike.

STOCKS AND SHARES.

Tuesday Afternoon.

Speculation runs less rapidly this week in the Stock Exchange markets than it did a week ago, and the gambling departments have come to something of a halt. This serves to throw the investment markets into greater relief, and for good securities the demand gradually spreads. Underground railway stocks of all kinds, investment and otherwise, are decidedly good.

Metropolitan Railway descriptions are amongst the chief features of strength. The Ordinary stock and the Surplus Lands both gained a point, while the 3½ per cent. Convertible Preference is no less than 4 points higher, nor is it easy to buy at all. District Ordinary has not altered materially, but the Extension Preference stock at 46 is up 1½, and the Guaranteed Preference shows a gain of ½ at 70, while the 6 per cent. Debenture only can be sold, there is no stock about. Great Northern and City Preferred shares spurted from 5s. up to 12s. 6d. City and South London Ordinary rose 1, and East London Ordinary has been quite active, the stock rising to 3¾ before a slight reaction occurred.

Central Londons are quiet and uninteresting, the opening of the Shepherd's Bush Exhibition this week not inducing fresh purchases. The 4 per cent. Debenture stock, however, hardened to 103. City and South London 4 per cent. Debenture stock is nominally 99 to 101, and if it can be procured at about par, the investment must surely be accounted cheap. Piccadilly 4 per cent. Debenture changed hands the other day at 95¾, free of stamp duty, and the supply of this "free" stock is getting absorbed. Charing Cross, Euston and Hampstead Debenture remains about 93.

Of the Underground Electric Railways of London issues, the only one to display any movement is the 4½ per cent. bonds, a point rise being marked against them. British Electric Traction rallied smartly, the Ordinary gaining $\frac{6}{16}$ and the Preference ⅛, while the First Debenture rose 1. Brush Electrical descriptions continue flat, and London United Tramways Preference fell ¼ upon the refusal of the House of Lords' Committee to accept the company's Bill. Dublin United Trams at 13½ are the fraction higher, and Anglo-Argentine Tramways go steadily better, the Second Preference being quoted $\frac{1}{16}$ better at 9⅝, while the 4 per cent. Debenture is also firmer. British Columbia Electric Railway Deferred stock has risen 2.

The Mexican-Canadian group has re-developed animation, and Mexico Trams gained 3, the bonds being ¼ to the good at 96¾. Rio Tramway bonds are firm at 98½, and the shares at 103 are now *ex* rights. In Canadian General there is not much quotable change. A fair amount of business is doing in the 5 per cent. Debenture stock of the Monterey Railway Light and Power Co.; the price is about 89, so that the yield on money invested comes to practically 5½ per cent. Mexican Light and Power Preference rose 1, and the Ordinary remains at 78.

Kalgoorlie Electric Power Preference have hardened to 15s. 6d., and there are many worse dividend propositions that do not pay 8 per cent. on the money.

Electricity supply shares are very quiet, but the tendency—where one exists at all—is rather upward. Charing Cross Ordinary and Preference rose ⅛, Notting Hills ¼, and County Debenture 1. Strenuous efforts are being made to work up a market in the Ordinary shares of the Victoria Falls and Transvaal Power Co. The sponsors in the House talk of the shares as being some of the cheapest they know, profess that they would not be surprised if a dividend (amount not stated) were to be declared within a year, and are ready to deal on the basis of 8s. to 10s. a share. It would seem tolerably manifest that a big block of shares is requiring to be worked off, and that the holders have seized upon the recent boomlet in Kaffirs and Rhodesians as a useful lever for getting rid of these Victoria Falls Ordinary shares.

Movements in the telegraph market are mostly favourable to proprietors, and almost the only weakness is a fall in Anglo-American Telegraph Deferred, the gambling counter. Eastern Ordinary and Eastern Extensions are both a trifle better, allowing for the dividend deductions. Western Telegraphs spurted, and West India and Panama made further progress upwards. Great Northerns regained their last week's decline, but Indo-Europeans are 10s. down. National Telephone Deferred rose a trifle; other telephone issues show no especial change.

Babcock & Wilcox have improved, and Westinghouse Debentures advanced, upon the issue of a report less unfavourable than some had anticipated. Rubber shares boomed, but deflated to-day (Tuesday), when there was a general recession from the high prices previously touched.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations May 11th.	Closing Quotations May 18th.	Business done week ended May 18th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2⅜ — 3¼	2⅜ — 3¼	..	..	..	Nil.
196,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	93 — 95	92 — 95	..	..	..	5 5 3
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	144 —145	143½ —144½	143⅞	..	— ⅛	5 10 9
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	98 —100	98½ —100½	..	..	+ ⅛	3 19 7
598,180	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 4s.	58 — 60	58 — 60	58½	58½	..	5 5 7
5,200,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101½—102½	101½—102½	102⅜	101½	..	5 17 1
5,200,910	Do. do. do. Deferred	Stock	½%	1½%	1 %	8/-	17⅛ — 18⅛	17⅛ — 17⅜	18	17⅜	— ⅜	1 16 0
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	98 —100	98 —100	..	..	..	5 0 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8⅜	8 — 8⅜	8⅛	8⅛	..	4 15 6
2,431,350	Commercial Cable Stlng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	91 — 93	91½ — 93½	92⅝	92⅛	+ ⅛	4 5 7
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8½ — 9	8½ — 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8½	8 — 8½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½ — 9	8½ — 9	..	..	..	5 11 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	8 16 6
60,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	12⅜ — 13⅛	12⅜ — 13⅛	13	12⅜	..	6 8 4
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100½—102½	..	..	+ ⅛	4 7 10
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	135 —137	133 —135	134⅜	133½	—2	5 3 8
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	86 — 87½	86½ — 87	86⅜	85⅜	— ⅛	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102½—104½	102½—104½	104⅜	..	..	4 6 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	12½ — 12⅝	12¼ — 12⅜	12⅝	12⅝	— ⅛	5 9 10
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	102¼	..	..	3 17 8
200,000‡	East & S. Afric. Tel., 4 % Mt. Db. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101 —103	99 —101	..	..	—2	3 19 3
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10⅜ — 11⅛	10⅜ — 11⅛	10⅞	10⅜	..	5 8 11
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	..	12⅛ — 13⅛	12⅛ — 13⅛	13⅛	12⅝	..	4 10 7
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18%	26½ — 27½	27 — 28	28	..	+ ½	6 8 7
14,800‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100½—102½	..	..	+ ½	4 7 10
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	52 — 54	51½ — 53½	51½	..	— ½	6 1 6
$41,880,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	78 — 82	78 — 82	..	..	..	4 17 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	73 — 76	73 — 76	..	..	..	5 5 3
594,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	6 %	⅞ — 1	⅞ — 1	19/9	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1/16 — 1/8	1/16 — 1/8	..	..	..	5 12 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	107 —108½	107 —108½	108½	..	..	5 10 7
5,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	123½—124½	123½—124½	124¼	124½	..	4 16 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	10½	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	6 %	10½ — 11	10½ — 11	10⅝	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅞	5⅜ — 5⅞	5¼	..	..	4 5 1
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	98½	98½	..	3 10 0
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅜	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1/5 — 1/7	26/6	..	..	..	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1/5 — 1/7	1/5 — 1/7	..	..	..	5 1 1
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	..	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
11,889‡	Reuter's	8	5 %	5 %	5 %	5 %	7¾ — 8¼	7¾ — 8¼	..	..	..	4 16 1
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100—102	..	..	..	4 8 3
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅞ — 7⅛	6⅞ — 7⅛	7	6⅞	..	5 12 8
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	5⅛	5⅛	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 10 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13⅜ — 14⅛	13⅜ — 14⅛	14⅛	13⅜	+ ⅛	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102⅜	101⅜	..	3 17 8
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛ — ⅜	⅛ — ⅜	17/6	13/6	+ ⅛	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	5 %	6 %	6 %	3/32 — 5/32	9/ — 9½	9⅛	..	+ ⅛	6 6 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8¼ — 9¼	8⅝ — 9⅝	..	..	..	15 17 8
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

830,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	9 %	10 %	9⅞ — 9¹⅛	9⅝ — 9⅞	9¹⅛	9¹⅛	+ ⅛	5 1 3
380,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5¼%	5¼%	5½%	6 %	6¼ — 6⅝	6⅛ — 6⅝	6⅝	6⅛	..	4 14 1
978,230	Do. 4 % Deb. Stock	..	..	..	..	..	92¼ — 94⅜	93 — 95	93⅝	91⅜	+ ⅛	4 6 6
265,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
880,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	20 %	4⅛ — 4⅛	4⅛ — 4⅛	90/7½	87/9	..	4 9 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝	22/6	..	..	4 0 0
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	⅞ — 1⅛	⅞ — 1⅛	..	..	+ ⅛	25 2 0
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2 — 2½	2 — 2½	..	..	..	14 0 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3¾ — 4	3¾ — 4	..	..	..	7 10 0
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾ — 4¼	3¾ — 4¼	..	..	..	4 8 11
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	95 —100	95 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	8 %	8 %	140 —144	142 —146	148	..	+2	5 9 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	123 —127	123 —127	125	..	..	4 14 6
800,000	Do. 5 % Cum. Perp. Pref. Stock ..	100	5 %	5 %	5 %	5 %	109 —112	109 —112	111	110½	..	4 9 2
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 8 6
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
188,801	British Electric Traction	10	3 %	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	20/-	17/6	+ 1/6	Nil
161,427	Do. do. 6 % Cum. Pref.	10	6 %	6 %	3 %	..	2⅛ — 2⅜	2⅛ — 2⅜	63/9	62/6	+ ⅛	8 17 9
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 88	85 — 89	87½	86	+1	5 12 4
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	66 — 70	65 — 70	..	..	— ½	6 8 7
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7⅛ — 7½	7⅛ — 7½	7⅜	7⅛	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅛ — 6⅜	6⅛ — 6⅜	..	..	+ ⅛	4 8 11
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
304,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 18 11
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	38 — 43	40 — 44	..	..	+1½	9 1 8
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	⅝ — 1⅛	⅝ — 1⅛	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
135,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	40 — 50	43 — 48	..	..	+1½	9 8 6
135,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	29 — 33	29 — 33	..	..	..	13 12 8
127,610	Calcutta Trams, 1 to 127,610	5	8 %	8 %	6 %	..	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	6 6 4
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	4 15 3
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99—102	99 —102	..	..	..	4 8 3
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9⅜ — 10⅜	9⅝ — 10⅜	..	..	..	7 4 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅛	5⅛	..	4 8 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape E Trams., 1 to 491,222	1	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	— ⅛	6 9 3
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	102 —106	102 —106	..	..	..	4 4 11
1,898,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	3 %	3½%	69 — 71	69 — 71	70⅛	69½	..	4 11 7
658,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	85½	..	..	4 12 0
658,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	52 — 54	52 — 54	52½	..	..	4 12 7
1,480,000	City and South London Railway	Stock	1½%	2½%	2½%	1½%	30½ — 31½	31½ — 32½	32½	31	+1	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	5	3½%	5 %	5 %	5 %	1 — 1½	1 — 1½	..	..	..	9 7 6
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	95 — 98	95 — 98	..	..	..	5 2 0

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME,	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	Closing Quotations May. 11th.	Closing Quotations May 18th.	Business done week ended May 18th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	1⅛ — 1⅜	1⅛ — 1⅜	24/-	..	..	7 12 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	23/9	..	..	4 16 0
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	12½ — 13½	13 — 14	..	..	+ ½	4 5 9
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	4½%	..	⅛ — ¼	⅛ — ¼	..	..	..	25 0 0
17,189	Do. "A" shares, 01—017,189	5	4½%	4½%	..	1¼ — 2¼	1¼ — 2¼	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	70 — 75	70 — 75	..	..	..	5 6 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	..	84 — 87	84 — 87	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	7/6	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	22/6	..	— 1/16	10 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	7⅞ — 7⅞	7⅞ — 7⅞	..	..	..	6 9 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	85 — 88	85 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	Nil	⅛ — ¼	⅛ — ¼	..	..	..	8 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	102 —108	102 —108½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15 %	11⅝ — 12⅝	11⅝ — 12⅝	12⅛	..	..	6 1 2
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4¾ — 5¼	5 — 5¼	5 5/16	..	— 5/16	4 5 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 5 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	..	14⅛ — 15⅛	14⅛ — 15⅛	14 15/16	14 11/16	— ⅛	6 11 2
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	Nil	⅛ — 1	⅛ — 1	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	8 6 8
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	Nil	2 — 3	2 — 3	..	..	..	4 8 11
899,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	3¾ — 4	3¾ — 4	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅜%	3 — 4	2½ — 3⅝	65/-	..	— ½	11 10 10
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	71 — 75	71 — 75	73½	..	..	5 6 8
5,722,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	38⅜ — 39½	39⅜ — 40⅛	40⅛	38 15/16	+1	1 4 9
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	69 — 71	70 — 72	71½	70	+1	3 16 5
3,295,000	Do. District	100	Nil	Nil	Nil	17⅛ — 18	17⅛ — 17⅝	17⅝	17½	— ⅛	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	⅞ — 1	⅞ — 1	..	..	..	..
814,016	Do. do. Defd.	1	Nil	Nil	Nil	31/32 — 1	31/32 — 1	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	31/32 — 1	31/32 — 1	..	..	..	5 19 5
600,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	96⅜ — 97⅜	96 — 98	97½	96½	+ ⅜	4 11 10
$6,000,000	Mexico Trams Co., Common Stock	..	..	..	..	146 —148	148⅜ —150½	150	146½	+2½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	96 — 97	96½ — 97½	97⅛	96⅜	+ ⅛	5 3 1
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	⅜ — ½	⅜ — ½	..	..	..	8 13 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	⅜ — ½	⅜ — ½	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	88 — 91	88 — 91	..	..	..	4 18 11
37,350	Telegraph Construction and Maintenance	12	15 %	17½ %	15 %	32 — 33¼	32½ — 34	33⅜	..	+ ⅛	6 0 0
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	101 —102	101 —102	102	101⅛	..	..
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	86 — 88	87 — 89	88⅜	..	+1	5 2 3
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	35 — 37	35 — 37	36⅜	35½	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	10 %	Nil	⅜ — ½	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	2¼ — 3⅜	⅜ — ½	..	..	..	..
245,404	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	78 — 82	2¼ — 3⅜	..	..	..	7 14 10
							78 — 82	..	..	..	4 17 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4½ — 4¾	4½ — 4¾	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 18 9
80,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	8¾ — 9	8¾ — 9	..	..	..	5 11 1
2,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	8 — 8½	8 — 8½	..	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 — 102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3⅞ — 4¼	3⅞ — 4¼	..	..	+ ⅛	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼ — 4⅝	4⅜ — 4¾	90/-	..	+ ⅛	4 12 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4¼	3¾ — 4¼	..	..	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	98 —101	98 —101	..	..	..	3 19 3
42,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	3⅝ — 4⅜	3⅝ — 4⅛	76/3	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	102 —105	102 —106	..	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	10¾ — 11	10¾ — 11	..	..	..	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	11⅝ — 12⅜	11⅝ — 12⅜	12⅜	12 5/16	..	4 16 0
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	121 —123	121 —123	..	..	..	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	2⅜ — 2½	2⅜ — 2½	..	..	..	8 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	6 13 4
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	96 — 98	96 — 98	..	..	..	5 2 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	5 14 3
50,997	Do. do. 6 % Pref., 40,001—50,000	10	6 %	6 %	6 %	10⅝ — 11⅛	10⅝ — 11⅛	11	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	105 —108	106 —109	..	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 7
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	⅛ — 5/16	⅛ — 5/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	3 %	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
490,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	60 — 63	60 — 63	..	..	..	7 2 10
$8,150,000	Electrical Dev.Co.of Ontario, 6% 1stMtg.Gold Bnds.	$500	..	..	5 %	88 — 90	88 — 90	89	..	..	5 11 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	4¾ — 5	4¾ — 5	..	..	..	5 10 0
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 — 5¼	5 — 5¼	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	7⅞ — 7⅞	7⅞ — 7⅞	..	..	..	5 9 8
$2,400,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	5 %	99 —101	99 —101	..	..	..	5 4 11
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	8 — 7⅞	7⅞ — 7⅞	..	..	..	6 1 8
90,000	Do. do. do. 4 % Deben. Stock	Stock	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 — 3⅛	1⅝ — 2¼	..	..	..	4 16 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	5 — 5⅛	5 — 5⅛	..	..	..	5 11 8
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	92 — 96	92 — 96	96/3	95/-	..	4 3 4
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6½%	4⅝ — 5	4⅝ — 5	..	..	..	5 0 0
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4¼ — 5⅛	4¼ — 5⅛	..	..	..	4 5 9
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
248,000	Do. 5% Mort. Deben. Stock Redem.	Stock	5%	5%	5%	86 — 88	86 — 88	..	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	88½ — 89½	89 — 90	89½	89½	+ ⅛	5 11 1
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	3%	77 — 79	77 — 79	77½	..	4 9 9
$1,500,000	Do. do. 7% Cum. Pref. Stock	Stock	..	..	7 %	111 —118	112½ —114½	114	113½	+1½	6 6 2
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	5 %	92 — 93	92 — 93	92⅝	92⅜	..	5 7 6
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	2¾ — 5	4⅝ — 5	96/3	..	..	2 10 0
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	4¼ — 5⅛	4¼ — 5⅛	..	..	..	4 15 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	99 —101	99 — 101	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	11⅛ — 12⅛	11⅛ — 12⅛	..	..	+ ⅛	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	6 %	8 %	1⅜ — 1½	1⅜ — 1½	28/6	28/-	+ ⅛	5 6 8
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..	..	5 6 8
194,684	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —106	102 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	10 %	8⅞ — 9⅜	8⅞ — 8⅞	..	..	— ⅛	6 15 7
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 13 4
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	4 %	3 %	4 %	2¼ — 3⅛	2¼ — 3⅛	57/6	..	..	6 9 0
20,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	⅝ — ¾	⅝ — ¾	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	25/-	..	— 1/32	5 6 8
220,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 0 0
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	⅝ — 1	⅝ — 1	17/6	..	..	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	2 — 2½	2 — 2½	46/3	..	..	10 0 0
375,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	80 — 84	80 — 84	..	..	..	5 7 2
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	5 %	87/8 — 88/8	87/8 — 88/8	18/11½	..	..	..
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 — 9⅝	9⅝ — 9⅞	9⅞	9½	..	6 11 2
81,979	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5¼ — 5⅜	5½ — 5⅝	5½	..	..	4 0 0

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. Interim Dividend.

Bank rate of Discount 2½ per cent., April 1st, 1909.

THE ELECTRICAL CONTRACTORS' ASSOCIATION (INCORPORATED).

By LEONARD G. TATE.

In September, 1905, the question whether the wiring contractor would or would not continue to be in existence caused a large amount of correspondence in the Electrical Review of that period, and an article setting forth the objects and aims of the Electrical Contractors' Association appeared in the issue of September 20th, 1905.

It is interesting to look back and see the amount of work of all descriptions carried out by the above Association on behalf, not only of its members, but of the wiring contractor throughout the kingdom, and to speculate as to what would have been the present state of the industry if the Electrical Contractors' Association or any similar organisation had not been in existence.

During the past four years not less than 40 municipalities have either applied for powers for carrying on wiring work themselves, and been opposed, or have been stopped from trading without powers. This session the Local Government Board brought before the House of Lords a Bill entitled the Electric Lighting Acts (Amendment) Bill including clauses enabling all local authorities to provide, let for hire, fix, repair, and remove, but not to manufacture, lamps, meters, electric lines, fuses, switches, fittings, lampholders, motors, and other fittings for lighting and motive power, and to make any charges for the hire and sale of the same as they may think fit.

This was opposed by the Association, and at the report stage previous to the third reading amendments were carried, including the words "Through a contractor but not otherwise," between the words, "to" and "provide."

In addition to this, a penal clause has been inserted whereby the local authority may be proceeded against under the Summary Jurisdiction Acts, should they not comply with the provisos of the Act.

Experience has shown that where the municipalities have obtained such powers, in nearly every case the wiring contractor has had to close his contracting business owing to the severe competition, and had the above clauses gone through without the amendments, it is impossible to calculate the damage that would have been done to the trade generally, and to the contracting firms throughout the country, who would have found themselves in a very unsatisfactory position.

Referring again to the article mentioned above that appeared in 1905, a large part of it referred to the hardships of the contractors with regard to the numberless rules and regulations for wiring which the supply authorities sought to enforce. Owing to the action taken by the Association, in nearly every case throughout the kingdom, the revised rules of the Institution of Electrical Engineers have been adopted by the authorities dealing with the supply of electricity, and the insurance companies.

With regard to the protection of members, many cases have occurred where the legal advice has proved an enormous benefit. One case within the recollection of many might be known as the "Sparking Plug" Case; in this the prosecution was inaugurated and carried through by the solicitors of the Association, and proved of considerable benefit not only to those members interested, but also to many manufacturers, and the trade generally.

Again, the Whitchurch Asylum case will be in the recollection of many, where the contractor obtained not only the moneys he had expended, but full costs as between solicitor and client.

Many other cases might be cited where the members have obtained individual relief and assistance, and a large meed of thanks is due to Messrs. Turner & Co. for the great amount of time and trouble they have given to this legal work.

Mention was made of the agreement with the cable makers; this has now proved of considerable monetary advantage to the members themselves, and at the same time has materially increased the funds of the Association.

The underlying principles of this agreement are:—

First, to limit the granting of trade discounts to other than trade buyers, and secondly, to induce contractors to purchase from members of the Cable-Makers' Association by returning to the contractors a rebate on their total purchases.

Possibly a few words of explanation would be useful at this point. Every contractor makes a contract with one or more cable makers for the supply of cable and wires for the term of one year, and in this contract, after allowing fixed trade and cash discounts, the cable maker agrees to return to the contractor a rebate based on the amount of goods purchased during the term of the contract.

This is on a sliding scale, and is increased in proportion to the amount purchased. Under the agreement between the two Associations, the individual contractor still makes his private contract with the cable maker, but should the total moneys paid by all the members of the Contractors' Association to all the members of the Cable-Makers' Association reach a fixed minimum, a fixed rebate would be paid to the Contractors' Association, which would take the place of the individual rebates agreed to be paid under the private contracts between members of the Cable-Makers' Association and members of the Contractors' Association.

Although this minimum was not reached during the 16 months ending December, 1908, the cable makers decided to pay over this rebate, and this has enabled the Contractors' Association not only to return to the contractors the amount of rebate that each individual contractor earned under his agreement with the cable maker, but also to pay out to each individual member a further sum proportioned to his buyings, and, in addition, to increase the general funds of the Association.

It should be made clear that all the transactions are carried out between the individual cable maker and the individual contractor, and that it is only at the end of the year that the returns are sent in to the secretary of the Contractors' Association; there is no interference whatever by the Executive Committee with the individual dealings between its members and the members of the Cable-Makers' Association.

The Association has grown during the past four years very considerably, and now has branches or representatives in about 50 towns throughout the United Kingdom over and above London and its suburbs.

The central board would very much like to have representatives in every town where electricity is supplied, and considering the Parliamentary work mentioned above that has been carried out by the Association, it clearly behoves every contractor throughout the kingdom to consider the advisability of joining.

The Association is now recognised officially by the Government departments and all the kindred institutions. It has a great and useful career before it, and as, during the past, it has been successful, owing to the hearty co-operation of its members, so in the future, with loyalty and the combination of all contractors throughout the kingdom, it will progress and flourish.

THE RATING AND COST OF STEAM ELECTRIC GENERATING STATIONS.

By H. M. HOBART, M.Inst.C.E.

(*Concluded from page* 823.)

The investigation has related exclusively to determining the *average* cost at the generating station per kelvin delivered from the station. This cost does not, however, serve without further analysis, as a suitable basis from which to arrive at the equitable price to charge individual consumers. Thus, taking from fig. 3B the case of a station designed for an annual output of 100 megakelvins and an average load factor of 0·6, with coal at 10s. per ton, the average cost per kelvin delivered from the station is 0·32d.

But while a consumer with a load of which the maximum exceeds the average by only 10 per cent. must be charged something like a farthing per kelvin *at the outgoing cables*,

a consumer whose maximum is ten times the average should be charged something like a penny per kelvin. The actual price per kelvin *delivered at the consumer's premises* will be greater than these figures by amounts sufficient to cover the annual costs associated with the transmission and transformation installations.

The first consumer's load factor would be 0·10, and the latter's 0·90. The determination of equitable charges to individual consumers is a highly complex matter. It is probably not capable of any exact solution. It is instructive to realise that in most large systems the capital outlay for mains and sub-stations will be more than 50 per cent. of the capital outlay for the generating station. The annual capital expense, however, may properly be taken at some 7 per cent. (to cover interest and maintenance) instead of the 10 per cent. for the generating station. A customer in the immediate neighbourhood of the generating station should bear but a small part of these additional costs, while a distant consumer should not be exempt from a large additional charge on this account. Thus the charge to a consumer is chiefly a function of—

1. The total annual output of the generating station.
2. The load factor at the generating station resulting from the aggregate of all consumers' loads.
3. The cost of fuel at the generating station.
4. The distance from the generating station to the consumer's premises.
5. The circumstance as to whether there are other consumers in the neighbourhood, or whether a transmission line must be provided for his express purposes.
6. The amount of electricity annually required by the consumer.
7. The consumer's own load factor.
8. The extent to which the consumer's heavy loads and maximum load do, or do not, overlap with those of other consumers, especially of the consumers, if any, supplied over the same transmission line.
9. The form in which the consumer requires his electricity. If he requires it in the originally generated form as regards pressure and periodicity, the appropriate price is lower than it is when he requires it transformed to a lower pressure, or at another periodicity, or as continuous electricity.

These influences control the charges which are made. The following tables, reproduced by permission from Snell's recent paper entitled "Cost of Electrical Power for Industrial Purposes," are very interesting in this connection :—

TABLE XVII.

Annual load factor.	I. London County Council, 1907. Estimated average charges for supply in bulk.			II. London County Council, 1907. Maximum prices to private power users.		III.	IV.
	(a) Extra-high-tension untransformed alternating electricity.	(b) Transformed alternating electricity.	(c) Continuous electricity.	(a) Transformed alternating electricity.	(b) Continuous electricity.	Administrative Co., 1906. Maximum prices.	Newcastle real cost based on 1907 figures and 1·66 diversity factor.
%	d.	d.	d.	d.	d.	d.	d.
10	1·002	1·159	1·453	1·738	2·179	1·50	1·49
15	0·728	0·839	1·042	1·258	1·562	1·16	1·07
20	0·531	0·679	0·836	1·019	1·254	1·02	0·86
25	0·508	0·583	0·713	0·875	1·069	0·94	0·74
30	0·454	0·519	0·631	0·779	0·947	...	0·65
35	0·414	0·474	0·572	0·710	0·858	0·81	0·60
40	0·385	0·439	0·528	0·659	0·792	0·75	0·55
50	0·344	0·391	0·466	0·587	0·699	0·72	0·49
60	0·317	0·359	0·425	0·539	0·638	...	0·44
70	0·297	0·337	0·396	0·505	0·594	..	0·42
80	0·282	0·319	0·374	0·479	6·561	0·64	0·39

While, as already stated, the consumer's load factor and the station load factor are quite different matters, it is interesting to see that the average cost per kelvin delivered from stations designed for various load factors bears a considerable resemblance to the prices to consumers with various load factors, which analysis and experience have indicated to be appropriate. Thus, let us take the average total costs per kelvin from fig. 3B for a station for 100 megakelvins per year, and place them, as in the following table, in parallel columns with the charges in the second column of the previous table—*i.e.*, the costs for extra-high-tension untransformed electricity.

TABLE XVIII.

Load factor.	Total costs per kelvin from fig. 3B for a 100-megakelvin per annum station.	Charges per kelvin for untransformed extra-high-tension electricity from L.C.C. 1907 estimated average charges.
0·10	0·80d.	1·00d.
0·20	0·50d.	0·59d.
0·30	0·38d.	0·45d.
0·60	0·32d.	0·32d.
0·80	0·29d.	0·28d.
1·00	0·25d.	—

It should, in conclusion, be pointed out that the costs worked out and plotted in the curves of figs. 1 to 4 will only apply when the stations are worked at the loads for which they have been designed. Thus, if a 100-megakelvin per annum station has an output of only 50 megakelvins per annum, the costs per kelvin will necessarily be greater.

Consumers are often charged so many pounds per horse-power per annum, the horse-power being taken as the maximum which will be required during the year. It is convenient, for a basis of comparison, to know the equivalent charge in pence per kelvin. In Table XIX is given the consumption in kelvins per maximum horse-power per annum for various load factors. Table XX gives the equivalent charges in pence per kelvin for various charges per maximum horse-power per annum for various load factors.

TABLE XIX.

Consumer's load factor.	Consumption in kelvins per maximum H.P. per annum.
0·10	654
0·20	1,310
0·30	1,960
0·40	2,610
0·60	3,920
0·80	5,220
1·00	6,540

TABLE XX.

Consumer's load factor.	Equivalent charges in pence per kelvin for following charges per maximum H.P. per annum—					
	£4	£5	£6	£8	£10	£12
0·10	1·47	1·84	2·20	2·94	3·67	4·41
0·20	0·73	0·92	1·10	1·47	1·83	2·20
0·30	0·49	0·61	0·74	0·98	1·22	1·47
0·40	0·37	0·46	0·55	0·74	0·92	1·10
0·60	0·25	0·31	0·37	0·49	0·61	0·73
0·80	0·185	0·23	0·27	0·37	0·46	0·55
1·00	0·147	0·18	0·22	0·29	0·37	0·44

The values in Tables XIX and XX are based on the assumption of 100 per cent. for the efficiency of the motor and its auxiliary apparatus. Thus, if the efficiency averaged over the entire time that the motor is in service is, say, 80 per cent., the equivalent charge should be increased to $(\frac{100}{80} =)$ 1·25 times the value in Table XX.

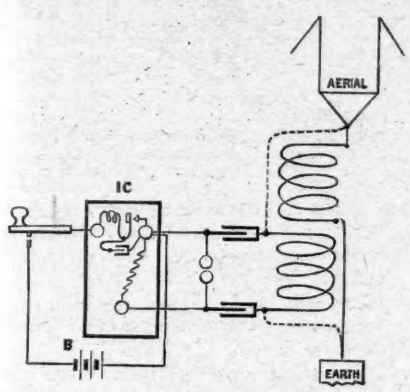
RADIO-TELEGRAPHIC INSTALLATIONS FOR SHORT DISTANCES.

As announced in our issue of the 30th ult., some experiments in transmission over short distances with small power were carried out under the direction of Major O'Meara, C.M.G., R.E., Engineer-in-Chief to the Post Office, between the two Post Office radio stations, situated at Hunstanton, in Norfolk and Skegness, in Lincolnshire. We are now enabled by his courtesy to give a few details of those experiments.

Temporary aerials 80 ft. in height were erected at each station, and the usual earth connection was utilised. The aerial consisted of two 3/18 stranded copper wires spaced about 4 ft. apart, up to their full height of 80 ft., at which

point they were extended outwards in a sloping direction away from the communicating station. The length of each sloping portion was 70 ft. A motor-car ignition coil of the small high-speed trembler type was used for charging the Leyden jars, with an average current through the primary coil of about 2 amperes, taken from three small secondary cells. The current in the aerial ranged from 1·5 to 2 amperes, as shown on a Duddell thermo-ammeter.

A diagram of the connections is shown below :—



I C, Induction coil; B, Battery.

Connections at Sending Station.

The secondary of the coil was joined to the inner coatings of two Leyden jars, each ·003 microfarad capacity, whose outer coatings were connected through an inductance of four turns of 7/22 copper wire wound on a box approximately 12 in. square. The spark-gap of about $\frac{1}{32}$ in. was joined across the jars.

The inductance in the jar circuit was exactly similar to another in the aerial, and formed with it the two portions of an adjustable transformer.

In another arrangement the aerial and earth connections were joined direct to the jar inductance, as shown by the dotted lines, and the aerial inductance was omitted. An ordinary Morse telegraph key carried the primary current without any appreciable sparking.

The signals at the receiving station 16 miles away were most satisfactory, both on a De Forest electrolytic receiver and on a Marconi magnetic detector. The wave length was 800 ft.

The results obtained from these experiments are very encouraging, but it must be borne in mind that every small station equipped will need the services of at least two skilled telegraph operators. This requirement is very costly, and will probably, in many cases, ultimately outweigh the cost of a submarine cable fitted with telephones, which anyone can work.

DUCDAME.

Amiens: What's that "ducdame?"
Jaques: 'Tis a Greek invocation to call fools into a circle.
— "As You Like It." II. v.

That is what it used to be. Now it may be said to mean the announcement of the meeting of any scientific society, although, in what follows, I shall only refer to those which deal with electrical matters.

There are several classes into which papers read before technical meetings may be divided. The first class consists of papers which might be entitled "My Station, by Me," and they raise a discussion around, not "His Station, by Him," but "Our Stations, by Us." In papers like this we get the opportunity of seeing what other people do, and of picking other people's brains in a manner pleasing to the picked ones. So we must not rail if it is found, as it too frequently is, that the papers are ill-written, rather fatuous, and generally possessed of a tendency to bore an audience composed of anything but authors or potential authors of similar papers.

In the second class we have papers which could be succinctly epitomised by the title: "What I think of My Thoughts"—on any subject. These are written from time to time by various well-meaning Elsley Vavasours, who turn out to be but very ordinary Johnny Briggses in other opinions than their own. Into this class fall, I grieve to note, most of the presidential addresses. Presidential addresses, by general custom, are not open for discussion at the meeting at which they are delivered. If they are afterwards discussed anywhere it is a proof that "What He Thinks of His Thoughts" has had power to stir some other people to write "What We Think of Our Thoughts," which may be considered a sign of vitality. For nothing is so true as this, that it is the point of view which makes the view what it is. Mr. A. C. Benson has elaborated this truism in one of his essays, and so I will not pursue it, although it is an attractive enough theme, and one eminently suited to anyone who has a touch—and who has not?—of the Elsley Vavasour in his composition.

The third place is taken by a class of papers, small in number, but nevertheless existing. These have no generic name, but they may be referred to as the Obscurantist Group. They contain the Obvious, disguised as the Highly Technical. These papers are intensely irritating to those who know anything about the subjects on which the authors of the papers claim to be authorities. In the Obscurantist Group we must take care not to include those papers which are written by men who live behind the scenes, and who consequently know, to their sorrow, all that I have or shall set down here; and who know how hollow is the pretence made to authority or real knowledge by some who occupy very high and distinguished positions.

The fourth place is filled by a class of papers which are of a peripatetic nature. If I may coin a word to signify this type, they are examples of extrospection. I do not know if there is any word recognised as belonging to the language which conveys precisely the meaning I want to express by that word. Introspection means looking within oneself. Extrospection means looking about and around oneself. Extrospective individuals are rather numerous, and very prolific in papers, which they write either by allowing others to write for them, or by collecting information of a miscellaneous character for years, editing it, and then thrusting it at an audience. They are usually quite eminent, and get office, medals, premiums, and other recognition. They are often so great that others hope to shine by reflected glory through speaking in their discussions. Extrospective papers are intended to show what fine fellows their authors are, and what a genius they have for imparting knowledge. As a matter of fact, they show that their authors have a talent of a somewhat nefarious kind for acquiring information from others, and then uttering it in an oracular manner as if it emanated from some secret fount of wisdom possessed only by them.

Really good and educative papers are few in number and rare. When they come they are frequently not discussed with appreciation, sometimes not even with understanding or intelligence. This is one cause of their rarity, for it is very discouraging, after laboriously preparing a paper which contains some real contribution to knowledge, to watch it subside, with a gentle suck or two, into a sea of platitudinary and Lethean mud, whence it will probably never emerge.

Over most of the papers we cannot write "Resurgam." When our "Ducdame" comes along we can, with little risk, write on it "Ça ira." And in most cases it is a good job too!

Abdeg Koru.

The Incorporated Municipal Electrical Association.—In our issue of April 23rd we printed the preliminary programme of the Manchester gathering of this Association (June 21st-25th). The full official scarlet-covered document has now been issued, applications for copies of which should be addressed to Mr. C. McArthur Butler, the secretary, at Staple Inn Building, W.C. The following is a list of the authors and papers, &c.:—

Tuesday, June 22nd, Manchester.—Presidential Address, by Mr. S. L. Pearce. "Cheap Units," by Councillor A. Sinclair, Swansea.

Wednesday, June 23rd, Liverpool.—"Influence of Metallic-Filament Lamps on the Electrical Industry and on Street Lighting," by Mr. E. E. Hoadley, Maidstone. "Modern Cable Systems," by Mr. E. M. Hollingsworth, St. Helens.

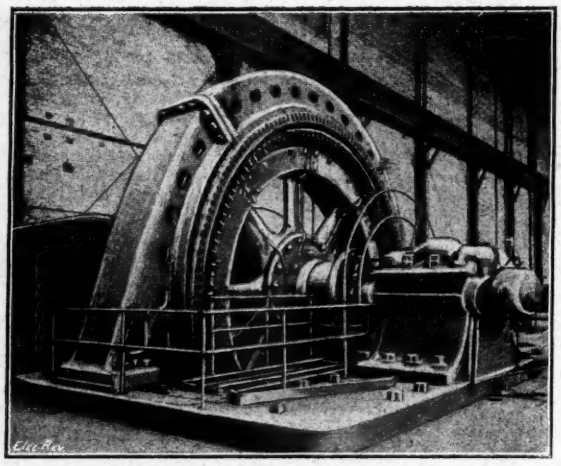
Thursday, June 24th, Manchester.—"Steam Turbines from the User's Point of View," by Mr. A. S. Blackman, Sunderland. "Notes on Condensing and Water Cooling Plants," by Mr. E. Lunn, assistant electrical engineer, Huddersfield. (This is a Travelling Studentship prize paper.) Annual dinner at night.

Friday.—Annual general meeting.

ELECTRICITY AT THE INDIANA STEEL CO.'S PLANT, GARY, INDIANA.

The Gary plant of the Indiana Steel Co., is situated on a 9,000-acre site, with a frontage of 1¾ miles, on Lake Michigan, some 23 miles from Chicago.

The complete scheme contemplates 16 500-ton blast furnaces of modern type, eight of which are now completed: these are linked to the gas engine power station and blowing houses through gas-cleaning plant, which adjoins the furnaces and stoves. The gas first passes into two "downcomers" leading into a dry dust catcher, 30 ft. in diameter × 40 ft. high, which is connected to a supplementary tank 14 ft. in diameter × 25 ft. high, one of which serves each pair of furnaces. This structure not only provides an additional dust-catcher but also acts as a water-valve for cutting off either furnace. This tank discharges into the primary wet washers, three of which are provided to each pair of furnaces. A certain percentage of the gas discharged from the washers is diverted to special furnaces under a battery of Rust boilers used for making steam, and about 30 per cent. is taken for heating the stoves; the remainder continues on to the secondary washers, including vertical scrubbers, about 14 ft. in dia. × 50 ft. high, and Thiessen washers, of which there are four to each pair of blast furnaces. From these final washers the gas is conveyed under slight pressure to the holders, each of which has 200,000 cb. ft. capacity, from which it goes to the electric power station and blowing engine houses.



6,000-H.P. Induction Motor, Driving Part of Rail Mill.

The water for the various processes described above is furnished by four large Platt turbine pumps.

The 16 blast furnaces will produce about 44,900,000 cb. ft. of gas per 24 hours, equivalent, when used in gas engines, to 500,000 B.H.P. Of this quantity, approximately 30 per cent. is taken for heating the stoves, 7½ per cent. is diverted to steam boiler furnaces, 5 per cent. is consumed by various auxiliaries or lost in the process of cleansing, 12½ per cent. operates the gas engine-driven blowing engines, and 45 per cent. supplies the electrical power station.

For the eight furnaces thus far erected there are two blowing engine houses of similar construction to the power station. Besides gas engines, each house contains two steam-driven Tod blowing engines, but when the plant is in full operation these will not be used.

Each of the 16 gas blowing engines consist of a horizontal, twin-tandem engine of 2,500 H.P., having cylinders 42 in. × 54 in. stroke, and two direct-driven blowing tubs having a capacity of 30,000 cb. ft. of free air per minute against a pressure of from 18 lb. to 30 lb. per sq. in.

The power station, which is 966 ft. long and 105 ft. wide, is ocated immediately adjacent to the blowing engine houses, and between the blast and open hearth furnaces. This places it advantageously for fuel supply, and ensures minimum lengths of transmission lines to the various departments using electric power.

In this central station are installed 17 horizontal, twin-tandem, double-acting gas engines, turning at a speed of 83⅓ R.P.M., 15 of which are designed for coupling to A.C. generators, and two to be connected to D.C. generators. The former are 25-cycle, three-phase, 6,600-volt machines, and the latter deliver current at a pressure of 250 volts. The engines have a rating of 4,000 H.P., and the generators 2,000 KW., but they are capable of carrying continuously 30 per cent. overload. The 17 units were built complete by Allis-Chalmers Co.; there are also two 2,000-KW. A.C. turbo-generators, which it is expected will take care of part of the peak loads.

The floor space occupied by one engine is 70 ft. by 44 ft., and the weight approximates 1,700,000 lb. The cylinders are 44 in. by 54 in. stroke, the crank pins are 20 in. in diameter, the shaft is 30 in. in diameter in the bearing, and the fly-wheel is 23 ft. in diameter, weighing 200,000 lb. The pistons and rods are water-cooled, water being introduced at the centre and flowing forward to a discharge in the frame for the front piston and backward to a discharge in the tail guide for the rear piston, each piston having its separate supply.

The engines operate with constant compression, thus tending to ensure smooth running under the highly variable loads to which they are subjected.

Direct current at 80 volts, supplied by a motor-generator, is used in the ignition system. Duplicate independent igniters are provided at each end of the cylinder to ensure prompt firing of low-heat value gases, and also to avoid the danger of shut-down due to short-circuit.

The engines start on compressed air, the starting device consisting of a small poppet inlet air valve at each end of each cylinder, operated by the layshaft. Air is admitted to each cylinder, in turn, at what would be the working stroke.

The exhaust from the gas engines is conveyed to a tunnel provided, at each end, with a stack 9 ft. in diameter by 92 ft. high. The same method of muffling the exhaust is provided for the blowing engine houses.

The A.C. and D.C. generators are of a type developed by Allis-Chalmers Co. for use with these engines.

In connection with the generators, there has been installed Cutler-Hammer remote-control field rheostats and field switches. The controlling apparatus is located in the basement as near as possible to the generators and is operated from a bench board located in the power house gallery. These rheostats are of a unique design, driven by means of vertical motors and are provided with automatic devices which ensure the stopping of the motor either when all resistance has been cut in or cut out of circuit. Means are provided, also, for operating these field rheostats by hand in case of damage to the motor.

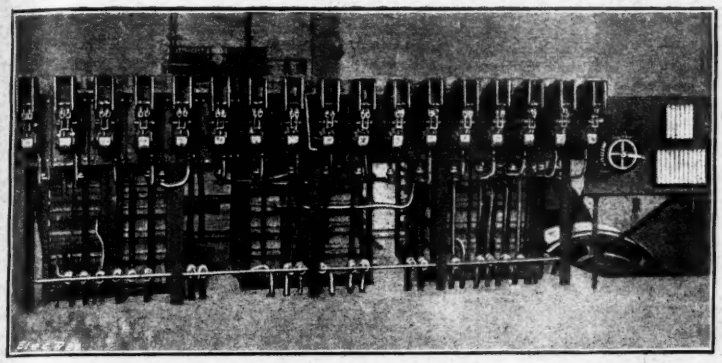
The energy generated is distributed, by duplicate overhead feeder systems carried on built-up steel towers 75 ft. high, throughout the works, where practically all the operations are carried out by means of the electric drive. There are three sub-stations, one in the rail mill with three 500-KW. motor-generators, and two others, each with half this plant capacity. The former supplies direct current in the rail and billet mills, and the last two supply the ore unloaders and transporters. There are also nine transformer stations, with a complement of nine 800-K.V.A. and 27 100-K.V.A. transformers for supplying 440-volt three-phase alternating circuits.

Interior of Power House, Showing Allis-Chalmers 4,000-H.P. Gas Engine Sets.

The electrical system, as a whole, is controlled from the power-house switchboard, which was designed by the Western Electric Co. With a view to securing economical conditions of working and neutralising the load variations, which, in the case of the rail mill alone, runs between 4,400 H.P. and 19,000 H.P., two 125-cell storage batteries have been installed, to charge into or discharge from both the A.C. and D.C. systems.

The control of the battery charge and discharge is effected by means of two motor-driven boosters which may be operated singly

or in parallel, their fields being controlled by a carbon regulator with its solenoid in series with the total output of the direct-current generators. The fluctuations of load on the A.C. circuit are transmitted to the battery by means of two 18-pole 2,000-KW. split-pole converters, designed to hold the constant A.C. voltage while permitting a sufficient range of D.C. voltage to cause the battery to charge from or discharge into the A.C. circuit through the converter. The field control of this converter to effect this variation in D.C.



SECONDARY CONTROL FOR 6,000-H.P. RAIL-MILL MOTOR.

voltage is accomplished by a special A.C.-D.C. exciter, which corresponds to the energy component of the alternating current output from the alternators. The various motor-generator sets, converter, &c., comprising this regulating system may be started and stopped from the bench board by means of Cutler-Hammer remote-control starting apparatus, and the fields of the various machines may be varied by means of remote-control field rheostats. One of these remote-control starters used in connection with a motor-generator set, which is started from the direct-current end, is designed to carry 10,000 amperes under maximum working load conditions.

From the blast furnaces the hot metal is carried in 40-ton ladles to two 300-ton mixers, passing again into 40-ton ladles, which are transported by a hot metal car and emptied by a 75-ton ladle crane into the open hearth furnace. A Wellman low-type charging machine deals with the charging of the cold scrap.

The plans of the plant provide for six batteries of basic open hearth furnaces, 14 to the building, of which two batteries, or 28 furnaces, are at present constructed.

The open hearth buildings are liberally equipped with electrically-operated cranes, both travelling and fixed. There are three of 125 tons capacity for operating 60-ton ladles, and equipped with seven motors of 330 H.P. total; three 200-ton four-motor stripper cranes, and sundry others for dealing with the ingots in the soaking pits.

From the open hearth building the ingots, weighing some 8,500 lb. each, are transferred to 12 soaking pits in the rail mill, and from the pits are delivered to the rolls by means of two electrically-driven buggies, operated automatically by means of a distant control system.

One control lever is provided for each buggy, having eight positions, one corresponding to the mill, six to the sites of the soaking pits and one being an off position.

The two control levers are interlocked so as to prevent both buggies coming to the mill at the same time.

The rail mill is equipped with 12 sets of rolls operated by six G.E. motors having a combined capacity of 24,000 H.P., and supplied through two 10,000-KW. 6,600-volt circuits.

The rail mill is equipped with 12 sets or stands of roll trains, operated by G.E. alternating-current motors, housed in a separate bay or "leanto," running parallel with the main building. The aggregate driving capacity is 24,000 H.P. Although the motors are provided with fly-wheels and operate in one direction, provision is made for reversing in case of necessity.

The first group of rolls consist of four stands of continuous 40-in. mills, each two of which are driven by a 2,000-H.P. (14-pole 214 R.P.M.) motor. They are arranged in tandem requiring no manipulation from stand to stand. Here, as elsewhere through the plant, sufficient distance is left between successive sets of rolls to enable a quarter turn of the ingot or bloom to be made, so that it is worked equally on all sides. The first two mills are at present equipped with 42-in. rolls, enabling 20 in. × 24 in. ingots to be used. After passing these four mills the ingot passes on to a 40-in. three-high blooming mill equipped with lifting tables, and arranged with a combined hydraulic and pneumatic balancing device. This mill, which is operated by a 6,000-H.P. (40-pole, 75 R.P.M.) motor, gives the ingot five passes. The ingot then passes through a 10 in. × 10 in. horizontal blooming shear, driven by a 75-H.P. induction motor, to a 28-in. roughing mill, which is three-high, and equipped with tilting tables. This mill has actually three stands of rolls, for roughing, edging and leading. The roughing stand, however, is the only one that is three-high, the other two stands being two-high. This mill is driven by a 6,000-H.P. (44-pole, 83 R.P.M.) motor, and gives the bloom three passes. After leaving the roughing mill, the bloom goes through a two-high 28-in. forming mill, driven by a 2,000-H.P. (36-pole 68 R.P.M.) motor, receiving but one pass. Then it is sent in turn through the finishing mills, which include the 28-in. edging and leading rolls mentioned, also three other sets of rolls operated by a 6,000-H.P. (34-pole, 88 R.P.M.) motor.

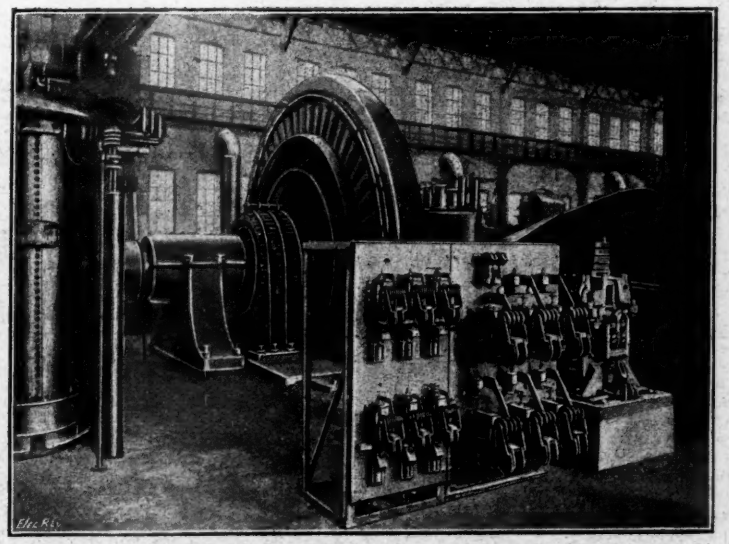
After the finishing or eighteenth pass, the rail travels through to the hot saws, of which there are five provided, thus cutting four rails to length. These saws are each driven by a 40-H.P. induction motor. These four rail lengths consist of half the ingot. As the capacity of this mill is 4,000 gross tons per 24 hours, it will be seen that there must be a four-rail length sawn about every half minute. The saws are 42-in. blades, arranged to be raised and lowered in unison by one controller by the hot saw operator. After leaving the hot saw run the rails pass over the usual cambering machine, and are run on to hot beds, preparatory to being dealt with in the finishing building.

The rail mill is not only the largest, but also the only motor-driven mill in the world rolling rails directly from the ingot without reheating.

The large motors are all of the three-phase type operating on 6,600 volts, and in all cases are built for 50 per cent. overloads. In the rolling mill proper are 21 tables and two transfers, mainly driven by 250-volt direct-current motors, and both these and the smaller induction motors are controlled by Cutler-Hammer remote control switchgear in which a master controller puts into operation series relays on each contactor of the resistance—these relays preventing each succeeding contactor from short-circuiting its step of the resistance until the current and torque have fallen below the amount for which the relay is set.

The control of the 6,000-H.P. and 2,000-H.P. motors for driving the rail mill was a more difficult problem. Despite the large fly-wheels, it was decided that to keep down current fluctuations means must be provided for introducing resistance into the motor circuit whenever the speed varied 2 or 3 per cent.

The preliminary control apparatus consists of a main oil switch, and a number of interlocked oil switches controlled by relays. The secondary control apparatus includes rheostats arranged in multiple delta and contactors operated by D.C. relays, so as to vary the current.



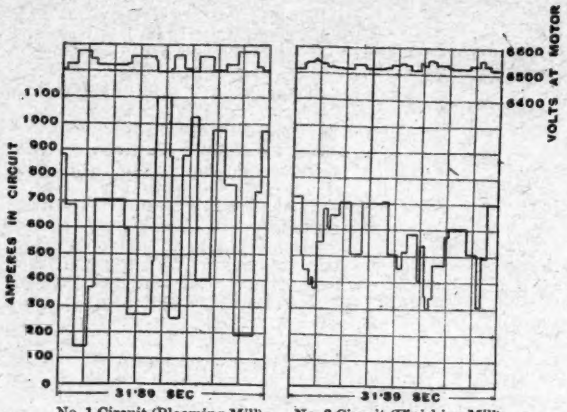
2,000-KW. SPLIT-POLE CONVERTER, WITH REMOTE-CONTROL GEAR IN THE FOREGROUND.

Resistance is automatically introduced into the rotor circuit as the load increases, and withdrawn as it decreases; resistance is also introduced into the main motor circuit by an overload relay when the load increases above a definite amount.

The master switches for operating the preliminary and secondary controllers are installed in pulpits overlooking the mills, and each has only two handles, one for reversing and one for applying and cutting off power; the remainder of the control gear is installed in the motor house. As regards large motors, in addition to the rail mill, the billet mill will require two 2,000-H.P. and three 6,000-H.P.

motors, while a further merchant mill is designed to operate with two 3,500-H.P. motors.

While our remarks are largely confined to the rail mill, which is in operation, some reference should also be made to other power users. Thus for handling the raw material arriving by ship, five ore unloaders are in use, each equipped with six direct-current motors of a total of 435 H.P.; these deposit material in a large



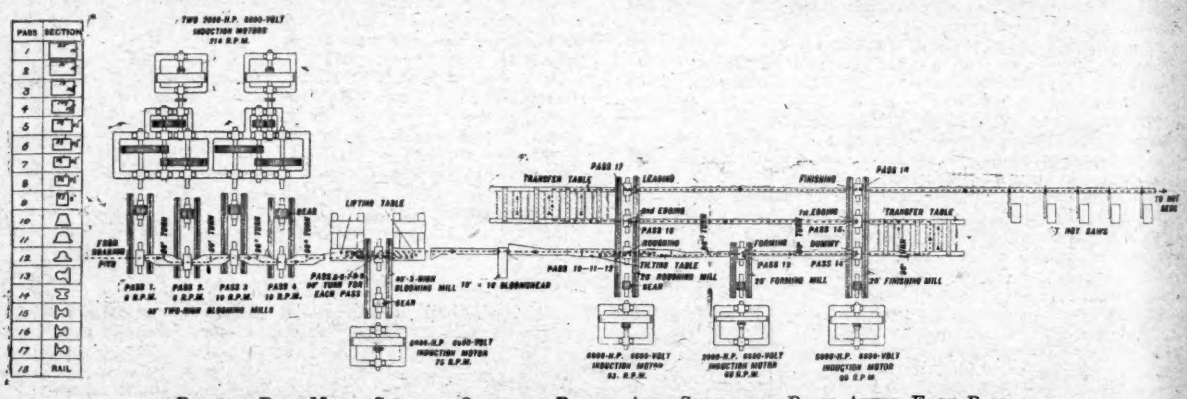
No. 1 Circuit (Blooming Mill) Motors 1, 2, 3. No. 2 Circuit (Finishing Mill) Motors 4, 5, 6.

VOLTAGE AND AMPERAGE CURVES: RAIL MILL.

trough, from which it is removed by five bridge transporters, each equipped with 14 motors of a total of 619 H.P.

The ore, limestone, coke, &c., is stored in bins, to which it is transferred as required by a 50-ton capacity car fitted with two 50-H.P. motors. From the bins, the blast furnace charges are carried by electrically-driven lurries to skip cars driven by 150-H.P. motors, which dump charges into the furnaces.

A large central pumping station, and repair shops with 2,440 H.P. of motors for driving purposes, are also features of interest.



PLAN OF RAIL MILL, SHOWING ORDER OF PASSES, ALSO SECTION OF PIECE AFTER EACH PASS.

Mr. Shover, to whose paper before the A.I.E.E. some reference has been made, states that after the rail mill motors had been started, it was discovered that the stopping of them was an important feature. The 2,000-H.P. 214 R.P.M. motor, when disconnected from the rolls, required 2 hours, and the 6,000-H.P. 83 R.P.M. motor, 1 hour 37 min. to come to rest.

In order to stop these motors within a reasonable length of time, D.C. at 250 volts was introduced into one phase of the winding through an external resistance after the motor had been switched off the A.C. circuit; this enabled the 2,000-H.P. motor to be stopped in 2 min. 55 sec. and the 6,000-H.P. motor in 1 min. 42 sec.

In the part of the works completed there are installed 110 electrically driven travelling cranes, 22,025 H.P. in D.C. and 5,312 H.P. in 440-volt A.C. motors, also 27,000 H.P. in 6,600-volt A.C. motors. It is expected that this horse-power will be doubled when the plant now under construction is completed and further added to when the whole of the designs are carried out.

Train Lighting.—In America train lighting is frequently carried out with a generating set on the locomotive. In the *Electrical World* (New York) of April 8th, a 20-KW. horizontal Curtis turbo-generator for this purpose is described. The generator is mounted on the top of the boiler, and is completely enclosed; the machine runs at 4,500 R.P.M., and supplies direct current at 110 volts. The weight of the set is 2,300 lb. A voltmeter and rheostat in the cab of the locomotive provide the only means of control required, the speed being regulated by a governor. Nine cars are lighted, each having 21 16-C.P. lamps, as well as the cab and headlight of the locomotive. The equipment has been adopted as standard by the Chicago, Burlington and Quincy Railroad for its suburban service.

THE USE OF ELECTRICITY IN MINES.

We have before us the monthly circular of the Durham Miners Association for April of this year. This is almost entirely taken up by a letter to the members on the subject of the verdict given by the jury in the sad calamity at West Stanley, and is written by Mr. John Wilson, M.P., the secretary of the Association.

The abilities and statesmanlike bearing of Mr. Wilson with regard to the complex problems of mines' management and labour, with which he has dealt for so many years, are too well known to require emphasis, and it only remains to say that the investigation into the cause of the West Stanley disaster is conducted in this circular in a most temperate and impartial manner. The very absence of partisanship renders the conclusions drawn much more impressive, and as they now stand, they constitute what may very probably prove to be a very serious indictment to the use of electricity in mines. Up to the present, so far as we are aware, no adequate reply has been given to this very serious statement, and in the absence of such defence, judgment against electricity will go by default. That the Stanley disaster has produced a crisis in the minds, not only of the men who have day by day to risk their lives in an admittedly dangerous employment, and who naturally object to having this danger enhanced by the introduction of elements of uncertainty, but also of owners and managers of collieries who are responsible not only for these lives, but for the security of a large amount of invested capital, is shown by the fact that since this disaster many manufacturers interested in the sale of electrical apparatus for colliery equipment have found it increasingly difficult to sell their manufactures. That this is the case can be most amply verified by anyone who cares to obtain the opinions of the present state of the colliery industry from those, who by their previous commercial experience of its conditions, are able to judge of the present situation.

As, therefore, it appears that the electrification of mines in Great Britain is now undergoing its trial, it may be advisable to examine very carefully the course of reasoning and the results deduced by Mr. Wilson. These results, it may be premised, are now the common property of practically every thinking pitman and mine owner in the north-east area, and their influence will extend to all the other mining districts of Great Britain. At the Coroner's inquest a series of questions were submitted to the jury, which Mr. Wilson arranges into two classes. The first dealt with such matters as precautions in watering and sweeping the mine to prevent dust explosions, the sufficiency of the current of air for ventilation, and the provision in all respects of the necessary appliances and materials conducive to the safety of the men and boys; also whether officials were competent in experience and ability to discharge their duties both as regards the general and special rules. The answers to these questions were that no fault could be found. The second set of questions, however, dealt with the cause, position and nature of the explosion. The jury found that the explosion commenced in the Busty seam, but were unable to say whether there was more than one explosion; that it occurred on the west side of the Busty seam between the curve and the air crossing; that it was a dust explosion, and not due to dust and gas combined; that the jury were unable to find the cause of the explosion. To the very important question, "Do the jury consider it advisable to make any recommendations or suggestions for the guidance of the present or future owners of West Stanley Colliery, or other similar collieries?" the jury gave a negative answer.

With this answer Mr. Wilson is not content, for the reason that suggestions given from such a jury would have had great weight, and would have been of immense value to the mining community in particular, and to the nation in general, because they would have been accepted as unbiased.

For our own part we are not altogether sure that a verdict of a Coroner's jury could be accepted as a final authority on a matter of this sort, involving a considerable number of highly technical points, and an investigation into the series of occurrences which are, so far as we are aware, at present without parallel. It must be remembered by our readers that the theory of explosion due to the presence of dust unaccompanied by gas is of a quite recent nature, and very careful investigation is necessary before its final accept-

ance. The importance of this to the electrical industry will be realised when it is remembered that the majority of the types of switchgear, at present offered to mining engineers, are designed rather from the point of view of gas tightness than the prevention of dust settlements. Mr. Wilson, however, takes up the matter from this point on an analytical basis, which cannot be too highly admired. Taking the evidence, he disposes of any possibility of the presence of gases in any sufficient quantity to cause an explosion. He next deals with the presence of coal dust. The seams were all dusty in varying extent, but every precaution was taken to reduce the danger arising therefrom. The practice was to sweep the bottom of the down-cast shaft, and along the intake to the stables once or twice a week. The screens were near to the downcast shaft. This made much dust, and a portion of this went down the pit. Therefore, the dust in the mine was caused not merely by the passage of the tubs, but also by that which went from the screens. Precautions, however, were made to meet that danger by watering the roof and sides, sweeping up the dust and sending it to bank, and these were so close and continuous that there was no dread of explosion from that cause. Taking every possible cause, such as shot firing and any defect in the lamps, it was elicited that explosives were only handled by the deputy, the detonators were never out of his charge, the key of the box in which they were kept was securely fastened to his clothes, the lamps were of the most perfect type, and except those damaged by the force of the explosion, were found in good order, and none of them showed signs of overheating owing to the presence of fire-damp.

Mr. Wilson then deals with the evidence of the expert witnesses relating to the cause of the catastrophe. Three of these were prominent mine managers, and the fourth, Dr. Thornton, whose reputation as Professor of Electrical Engineering at Armstrong College, Newcastle-on-Tyne, is too well known to require comment. Dealing first with the mine managers' evidence, Mr. S. Tate concluded that it was not a fiery mine; that it was ascertained beyond doubt that no shot firing took place at the time of the explosion; that there was no evidence of lucifer matches being taken into the pit, or other means of obtaining a light improperly, nor had the smoking of tabacco been hinted at. He was not able to give the cause, but he gave the locality, which was between the curve of the overcast in the west way of the Busty seam. It was also evident that the force went both ways. Although he could not give the cause, he could negatively state what had not caused the explosion. Mr. W. C. Blackett formed three theories of probable approximate locality and possible ignition. The first two localities, the Towneley and Brockwell seams, were given up for the Busty seam, and the only cause he could conceive was a very thick and heavy cloud of dust being raised by a fall of stone which may have been brought about by an accident to a set which was being hauled out-bye. He was in difficulty as to the connection between the explosion and the fall. No matter how large the fall of stone, or how dense the cloud of dust, there must be something to ignite it. Mr. Blackett says, "What has ignited such a cloud of dust I cannot say." He also found arguments difficult to answer, such as the position of the baulks under the fall, which were certainly thrown out-bye, and the general indications of damage. The third mining expert was Mr. P. Kirkup, who, after careful examination of the machinery and material, of which the different machines, cables and workings were made, &c., was of the opinion that the West Stanley Colliery was well managed by the owners and officials with due regard to the safety of the workers who were employed therein. He again was met by the difficulty of igniting the dust, and gave two instances, one where in a mine in Yorkshire, the dust raised by a slow horse-drawn set inflamed at an open light, and the other where dust was ignited by sparks caused by the friction of a pulley. The former of these is discarded by Mr. Wilson because there were no naked lights. As regards the second, Mr. Wilson points out that Mr. Kirkup, in spite of the point advanced as to possible friction, plainly voices his inability to indicate a cause.

At this point the Coroner re-called Mr. Hall, the manager, for further questioning bearing on the subject of friction of wheels, the point being that the tubs were travelling slowly, and Mr. Hall's opinion seems to be that it is probable that the explosion could be caused by a spark at the curve due to the tubs, provided that the tubs were off the way, owing to a quantity of loose and dry coal dust in suspension close to the floor. He did not think such an opinion was inconsistent with the indications as to the place where the explosion occurred, although all the expert witnesses put the initial site of the explosion on the in-bye side of the curve. Mr. Wilson points out that this conclusion is arrived at in a pit well managed, where great emphasis is put on the continuous sweeping up of the dust and continuous watering, and yet at a point about 50 yards from the shaft there could be raised a cloud of dust, by means of tubs getting off the way, sufficiently large to be ignited by a spark, and cause a disaster so terrible as this at West Stanley.

The concluding part of the evidence at the inquest lay with the Durham Miners' Association, who had three witnesses. There were two stone men, R. Coxon and W. Douglass, and Dr. Thornton. The two stone men gave evidence that about four months previously they were working in the Towneley seam. About 50 yards from them was a man working with a coal-cutter, and there was an electric switch. They saw a white flash which filled the whole place. They thought it came from the direction of the switch box, because on looking towards it, they saw the fire going away from it. They were quite clear and emphatic on that point, and that as a consequence the electric coal-cutter stopped. Dr. Thornton's evidence was that he went down the pit on two separate days, making long and careful investigations, and came to a conclusion in harmony with the mining experts as to the points within which the ignition took place. Mr. Wilson quotes certain passages from Dr. Thornton's report, from which we may extract the following:—

"Danger may occur in two ways, first by accidents to the transmission system of cables, fuse boxes, junction boxes, and the like; and, secondly, by lack of protection of live parts of electrical machinery at points where damage may be done by mechanical or electrical action."

"The owners of this particular colliery appear to have made every effort to equip their workings with thoroughly efficient and up-to-date electrical machinery and cables of standard mining pattern throughout. Both in the quality of the plant and its general maintenance, the system, taken as a whole, is excellent. The faults which, in my opinion, it has, and which will now be indicated, are those which might occur in any electrical colliery plant under conditions as at present carried out."

Another extract describes the dangerous portions of the electrical equipment:—

"The terminals of all the motors on the small three-throw pumps were too close together; those on the starting switch were 2 in. apart between the metal on a teak block; those on the motor itself were 1½ in. apart on a slate base, but with an iron hood covering."

"In my opinion, no 300-volt terminals, whether on motors or apparatus of any kind for use in mines, should be less than 4 in. or 5 in. apart, and should always be well enclosed from dust or moisture by covers, not hinged, but bolted on all round with a wide flange and rubber joints. I noticed that in the gateway end switches not at bank, there was a thick accumulation of dust inside the boxes between the terminals. These boxes should also not have hinged lids, but the covers should be bolted firmly on, and have side flanges and rubber joints instead of the narrow edge and rubber inset ring now used."

"A dust explosion to be maintained, must be started by a flash accompanied by concussion sufficient to disturb the dust in the immediate neighbourhood, or by a continued exposure of a red hot surface to an atmosphere already charged with coal dust to a degree suitable for a dust explosion to be transmitted."

Apparently there were three possible causes, the breaking of a lamp in front of a large pumping tank in the Busty seam, the breaking of a fuse in the pump house in the Busty, or a short circuit set up by the train of coal dust between the terminals in any of the junction boxes or gateway end switches. The first and second are unlikely; as to the third we quote as follows:—

"There was, however, a junction box in the Busty West and on the north side just before reaching the small three-throw pump. This box is in Court, smashed, electrically disembowelled. No other box in the mine was found in this damaged state. The electrical pressure was on its terminals day and night. This box was fitted close to the roof exactly where Mr. Tate and Mr. Blackett locate the explosion, that is, 130 yd. in-bye from the bend (curve) at the Busty shaft siding, and close to the starting point suggested by Mr. Kirkup."

That Dr. Thornton appears to be tolerably certain that this explosion was possibly caused by coal dust on electric terminals is evidenced by the recommendations placed by him before the jury:—

"This is the first time a large explosion has been suggested to have been possibly originated from the flashing over of coal dust between electric terminals. The Home Office Rules do not consider this flashing over action due to coal dust. A clause should be inserted covering this possibility. The practice of enclosing all three wires or phases in one box should be abandoned, and three separate fuse or junction boxes used. No electrical plant should be allowed to be set to work after installation without examination by a certified electrical engineer, who should be appointed under the direction of the chief electrical expert of the Home Office."

The comments upon Dr. Thornton's evidence by Mr. John Wilson, who has no interest to serve beyond the securing of safety to life and whose standpoint of view may, therefore, be taken as the general opinion, not only of pitman, but of all mine owners, is as follows:—

"Speaking for myself alone, I am convinced that the explosion was caused by electricity within the points fixed by the three mining experts and Dr. Thornton, and at the place and in the manner suggested by him; and in your name I ask that the defects should be remedied. The lesson taught us at West Stanley is clear and emphatic enough in its sadness.

"We are not rich enough in human life to pay a price as great as we paid there on February 16th. Prevention therefore, must be the aim of employer and employed alike."

The electrical industry is, therefore, in the following position:—A serious indictment as to safety of the use of electricity in mines has been made by an expert, whose scientific accuracy is of more importance to him than any commercial or political interest. It is emphasised by a disaster almost unparalleled in tragical significance. It has gained the attention of men, who, both in their private dealings as engineers and mine managers, are in a position to totally destroy the further development of electricity in colliery work if they are satisfied that dangerous elements are included with which they are unable to cope, and are also able, by means of their Parliamentary representation, to bring into force restrictive Acts which may, if unwisely constructed, prove a permanent fetter to a branch of electrical engineering, which, at the present date, is the most profitable we have. Under these circumstances it is surely worth the while of every electrical engineer interested in this phase of development of his industry to face the problem, and either show adequate proof that electrical mining machinery is not so dangerous as it appears from the foregoing evidence, or else take the initiative in securing that dangerous elements shall be resolutely eliminated. Initiative, rather than compulsion, is by far the better alternative.

THE FIFTH MORDEY REPORT ON THE "G.B." SYSTEM.

At last, the L.C.C. has seen fit to disclose the fifth report by Mr. Mordey, its expert adviser in the matter of the "G.B." system installed in the Mile End Road. This report, as Mr. Mordey's covering letter of April 5th explains, deals with the objections of the Chief Engineer and Chief Officer of the Tramways contained in their reports of September 1st and August 26th last, and apparently confirming a previous report submitted to the Highways Committee in July, 1908.

It will be seen that the various objections are, for the most part, trivial, and were *all* removed at the time of this fifth report; and in view of this, we ask what were the objections (cited in July, 1908) which the officers considered as not satisfactorily removed, and which was one reason mentioned by the Highways Committee in its April 1st report for rejecting the system?

But our readers can judge of the chaotic methods of the Highways Committee from the following paragraph in Mr. Mordey's letter :—

I am sorry I have not had an opportunity of going over these points in detail, either with the Committee or with the officers in question, as I am sure it would only have been necessary to examine them one by one to dispose of them.

This from the Council's specially appointed adviser, on whose advice, it will be remembered, the system was to stand or fall.

NOTES ON DEFECTS OF G.B. SYSTEM.

Summary of Defects.

Statement sent by Chief Officer of Tramways to W. M. Mordey, dated August 26th, 1908 :—	Notes by W. M. Mordey, April 5th, 1909 :—
(A) *Broken stud-heads.*	
Causing cracked stoneware T-pieces through which water and other matter leaks, thus making the studs sticky in action, so that when a car passes they either remain dead or alive. In several instances the shank of the stud under the head was found broken. In a few cases the cement joint between the T-piece and the cable pipe became defective, probably due to the vibration of the heavy traffic.	Using cast-steel instead of cast-iron will prevent breakage. In trial, 1,000 T-pieces examined; more than 100 slightly cracked, but only one had allowed water or other matter to leak in. This can be prevented by suitable adjustment of the head.
(B) *Leakage between stud-head and rail.* Causing :—	
(1) Live studs, the circuit being maintained through an arc between the carbon contact and the cable by leakage from the stud-head to the rail through wet road refuse.	No such case found on trial track.
(2) Excessive leakage to earth during adverse weather conditions.	These live studs are now prevented.
(C) *Defects in stud mechanism causing live studs.*	
(1) Defective enamelling on "knock-on" causing rust and consequent stickiness.	This leakage is quite unimportant so far as cost is concerned. On the average it is certainly not as much as $\frac{1}{10}$th of 1d per car-mile.
(2) Some of the trouble in the studs was probably due to the small current-carrying capacity of the leads.	No such case found on trial track.
(3) Destructive effect of gas generated when arcing took place between the carbon contact and cable.	Tests already reported show current-carrying capacity sufficient. Further borne out by condition of studs on trial track.
(4) Insulators to which springs were attached found broken.	No evidence of this found. In any case, arcing, which is supposed to cause it, is now prevented.
(5) Flexible leads getting jammed between the spring and the guide.	Prevented by small insulators of improved design at the cost of less than 1d. each.
(6) Stickiness in studs probably caused by carbon deposit and moisture.	None found on trial track; might be caused occasionally by arcing, which is now prevented. Absence of arcing and reasonable drying of conduit will prevent this.
(D) *Resistance Studs.*	
(1) Not properly designed for current which they had to carry.	Both these avoided by proposed modification of special work.
(2) Unsuitable design of stoneware T-piece, making it most difficult to connect up stud even with a very small lead.	
(E) *Access Box Covers.*	
See Chief Engineer's statement.	These have been already partly dealt with. They present no serious difficulty.
(F) *Ventilation.*	
See Chief Engineer's statement.	Already reported on. This presents no difficulty.
(G) *Skates.*	
See Chief Officer's statement.—Summary. After referring to preliminary difficulties he proceeds :—"The cars inspected by the Board of Trade—and all cars subsequently run in service were fitted with two three-coil skates. The great disadvantage of this arrangement was that the magnets absorbed an abnormal amount of energy.	The energy absorbed is now less than that taken up by one 16-c.p. lamp.
The G.B. Co. were requested to submit a design for a two-skate equipment, which would allow for the necessary gap for the plough carrier between the two skates. This design has, I believe, been prepared, but whether this would give any better results than those obtained from the skate equipment originally designed by the G.B. Co. is extremely doubtful.	It is a great improvement. It halves the energy and doubles the speed.
Great disadvantage of the two-skate equipment would be that each stud would be operated twice when a car was passing.	This seems to give rise to no difficulty, but in report of March 31st, I pointed out that one of the collectors can very probably be dispensed with altogether.
Defects in Collector Skates.	
(1) Being insulated with wood sheathing, the water and mud permeates the fibres and causes electrical leaks of considerable magnitude during wet weather.	
(2) The large area of highly magnetic metal under each car is responsible for the collection of a large quantity of metal *débris*, resulting, in some cases, in very serious short-circuits.	Greatly improved results should be obtained with the new design. No trouble met with in trial runs.
(3) The magnet must of necessity be carried close to the level of the road; consequently, any displacement of setts or wood-block paving results in the fouling of the skate therewith and breakage of the equipment.	Risks from this cause are very slight with the L.C.C. standard of paving.
(4) Breakage of the collector chains in service, resulting in short-circuits and damage to equipment generally.	I agree, and had arranged for steel instead of cast-iron chains. This would prevent breakage.

GERMAN BANKS AND THE ELECTRICAL INDUSTRY.

The subject of the position of the large German banks during 1908, as being of interest to the electrical industry, was discussed in the *Elektrotechnische Zeitschrift*, of May 6th, by Dr. Oscar Stillich, who points out that in that year there was a decline in the condition of the world's trade. It was not a crisis, but a depression which began to overshadow German economic life, and which still continues, although its effects were perceivable least in the electrical and coal industries. The actual yield on the shares of the five leading banks only ranged from 4⅜ per cent. to 5½ per cent., the profits being derived from interest, commission and financial transactions, together with the purchase and sale of securities on the Stock Exchange. It is mentioned in the report of the Deutsche Bank that the following securities were taken over in 1908: 5 per cent. bonds of the German Transmarine Electricity Co., 4½ per cent. bonds of the Berlin

Electricity Works, the Rheinfelden Power Transmission Co., the Rhenish-Westphalian Electricity Works, and the Allgemeine Elektrizitäts Gesellschaft, and 4 per cent. bonds of the Berlin Elevated and Underground Electric Railway Co. In addition, the bank co-operated in the increase of capital by the Electric Lighting Co., of St. Petersburg, and by the Bergmann Electricity Works Co., of Berlin. As a rule these transactions were not solely carried out by the Deutsche Bank, but in association with other large banks, and they are characterised as syndicate operations.

The principal banks are specially interested in a number of industrial undertakings, but the question whether the banks dominate industry, or the latter dominates the banks, is still an open one. It has, nevertheless, the appearance that the electrical industry, like the coal and iron and steel industry, is more and more emancipating itself from the large banks. This is expressed in the case of the electrical industry by the circumstance that no mention is made in the bank reports of the formation of trustee banks by the Allgemeine Elektrizitäts Gesellschaft and the Felten and Guilleaume-Lahmeyer group. It is well known that the movement of concentration in heavy industries leads to greater independence of the latter in relation to the banks, and the point is specially put forward in the report of the Dresden Bank, which adds that if the opportunity of large profits is thereby diminished in a high period of prosperity, the disadvantage is in some measure counterbalanced in periods of depression, as the banks are less interested in the contractor's risk.

Dealing more closely with the banking reports for 1908, Dr. Stillich refers first to the Deutsche Bank, which established the Bavarian Nitrogen Works. The latter is a subsidiary of the Berlin Cyanide Co., and has just received from the Government a concession to utilise the water powers of the Alz for 70 years, the concession being irrevocable during the first term of 40 years. The Disconto Gesellschaft states that the Internationale Elektrizitäts Gesellschaft, of Berlin, which, in the course of years, mainly concerned itself with its investment in the Compagnie Parisienne de l'Air Comprimé, Force Motrice et Eclairage Electrique, went into liquidation. The bank lost a lot of money in the Paris undertaking, although the results are now expressed as satisfactory. In the case of the Dresden Bank, which is interested in the Transvaal mining industry, it is mentioned that this specially concerns the General Mining and Finance Corporation. The 5 per cent. debentures in the Victoria Falls Power Co., which were taken over by the bank in conjunction with the members of the financial syndicate of the A.E.G., were introduced on the Stock Exchange and completely realised. The English company in question has now concluded important contracts for the supply of power, and intends to build a further extensive station on the Witwatersrand. The construction will be jointly carried out by the A.E.G. and the Siemens-Schuckert Works, and the placing of the work with these two German companies may be regarded as a fresh important success of the home industry.

The Dresden Bank also co-operated in 1908 with the Schaaffhausen Bank Verein in the formation of the German South American Telegraph Co., which is intended to extend the network of German submarine cables in two directions—namely, first to Brazil, and secondly, to the German colonies in West and South Africa. The German Government has undertaken to grant subsidies to the company for a period of 40 years. In conjunction with other German and Swiss firms, the Schaaffhausen Bank Verein also participated in the establishment of the Laufenburg Power Works at Laufenburg, Switzerland, the object being the erection of a large hydro-electric station on the Rhine, near Laufenburg, for the supply of electrical energy to the adjoining industrial districts. In conclusion, Dr. Stillich refers to the position which the banks assume in relation to the future condition and course of trade, but he considers their views too optimistic to have any prospect of realisation in the present year, nor does he think that a new period of high prosperity will soon be approached.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

COSTA RICA.—The exact net and gross weight in kg. should be marked on each package, and specified on invoices, bills of lading, &c. The net weight in kg. of each class of goods should be given, and the country of origin of the goods should be declared on all documents. Consular invoices in triplicate, in Spanish, on special forms to be obtained at the Costa Rica Consulate, must be made out and signed by the merchant; these state the name of vessel, captain, and port of destination, the name of shipper, name of person for whose account the shipment is made, the name of consignee, the marks (in plain letters, not cipher numbers) and the numbers on the packages, the description and value of the contents, the net weight in kg. of each article when more than one kind is contained in a package, the gross weight of each package in kg., the amount of charges to port of destination, such as insurance, freight, commission, &c. (to be given in one sum and called "gastos hasta el arribo"). The Government of Costa Rica imperatively requires that the approximate "gastos hasta el arribo" be shown in the Consular invoices against each separate article, adding the total amount of charges to the total value of the goods at the foot of the invoices. The fees charged for Costa Rican Consular invoices have been abolished, but a surcharge of 2 per cent. of the amount of duty levied on merchandise is now collected at Costa Rican Customs houses in lieu thereof.

100 centimos = 1 peso = about 1s. 11d.
Kg. = 2·204 lb.

	Cents per kg.
Conduits of earthenware	1
Asphalt, schest, bitumen, tar and pitch	2
Articles for lighting, of faience	11
Ditto, of metal	22
Machine belting, of caoutchouc or leather	2
Pulley blocks weighing less than 2 kg.	54
Boilers	7
Wire cables	2
Rail and tramway carriages	22
Railway chairs	11
Old copper	2
Iron framework for bridges and buildings	2
Glass articles for lighting purposes, lamp glasses	11
Articles of gutta-percha	54
Sheets of gutta-percha for machine packing	9
Scientific instruments	11
Lamp-shades of faience, glass lanterns	11
Mining and agricultural machinery	free
Artificial magnets	11
Articles of metal not separately mentioned:	
Weighing 2 kg. and less	54
Weighing more than 2 kg.	11
Iron plates	2
Pulleys of metal weighing less than 2 kg.	54
" of wood	4
Metal pumps	11
Rails	2
Tramways and accessories	free
Wire	7
Machinery of all kinds for industries	2
Gas and petroleum engines and fuel for same	free

Goods not specially mentioned in the tariff are assimilated to those enumerated in the tariff with which they present the greatest analogy or affinity, either owing to the kind and quality of the component material or by reason of their texture, workmanship or form, and also of their use or application, and are liable to the duties on the articles to which they can be assimilated.

NEW PATENTS APPLIED FOR, 1909.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

10,424. "Improvements in or relating to condensers." R. M. Thorburn. May 3rd.

10,446. "Improvement in or relating to terminal or contact pieces, and body of electric incandescent lampholders." M. Favero. May 3rd.

10,450. "Improvements in telegraphic receivers." A. Pictet. May 3rd. (Complete.)

10,456. "Improved apparatus for distributing electric current, gas, or other fluid." L. Pralon, I. Francon and G. Fournier. (Date applied for under Sec. 91 of the Act, May 2nd, 1908, being date of application in France.) May 3rd. (Complete.)

10,497. "Improvements in and relating to alternating-current dynamo-electric apparatus." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges., Germany.) (Application for Patent of Addition to No. 786, of 1909.) May 3rd. (Complete.)

10,539. "Improvements in electric terminals." C. J. Beaver, J. Stratton, W. Shaw and E. A. Claremont. May 4th. (Complete.)

10,550. "Arrangement for varying the connections of electrical apparatus." Siemens Bros. & Co., Ltd., E. F. H. H. Lauckert and J. Nebel. (Siemens and Halske Akt.-Ges., Germany.) May 4th. (Complete.)

10,555. "Improvements in or relating to means or devices for bending electrical conductors, rods, tubes and the like." H. W. Handcock, A. H. Dykes and J. J. Rawlings. May 4th.

10,564. "Improvements in or relating to electric batteries." D. Mathieu. May 4th.

10,565. "Improvements in terminals for electrical batteries and the like." D. Mathieu. May 4th.

10,585. "Improvements in electric signalling apparatus." G. M. Newbery. May 4th.

10,586. "Improvements in or connected with wireless telegraphy and telephony." J. Rymer-Jones. May 4th. (Complete.)

10,588. "Improvements in commutators on dynamo-electric machines." Hon. C. A. Parsons, A. H. Law and J. P. Stockbridge. May 4th.

10,594. "Improvements in and relating to protective devices for electric distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 4th.

10,600. "Improved construction of electrical resistance devices." H. S. Martin. May 4th.

10,607. "Improvements in or relating to electric cables." Key Engineering Co., Ltd., and L. Andrews. May 4th.

10,608. "Improvements in or relating to boxes for use in electric wiring systems." H. H. Hill. May 4th.

10,655. "Improved process for the electro-deposition of iron." S. O. Cowper-Coles. May 5th.

10,663. "Improvements in and relating to protective devices for alternating-current systems." H. Brazil and H. Cooch. May 5th.

10,665. "Improvements in and relating to alternating electric current commutator machines having two working and two exciter windings." Allgemeine Elektricitats-Ges. (Date applied for under Sec. 91 of the Act, May 6th, 1908, being date of application in Germany.) May 5th. (Complete.)

10,680. "Improvements in and relating to the starting of electric motors." W. D. Kilroy and Eversbed & Vignoles, Ltd. May 5th.

10,694. "Improvements in telephone transmitters or the like." L. H. Rittman. (C. L. Chisholm, Canada.) May 5th.

10,698. "Improvements in and relating to the operation of electric switches, circuit-breakers, cut-outs and the like." W. B. Burge. May 5th.

10,709. "Improvements in or relating to electric distribution systems." L. T. Stone. May 5th.

10,729. "Improvements in through control magnetic switches for electric lighting installations on trains." W. N. Cochrane. May 6th.

10,739. "Improvements in the manufacture of junction fittings of metallic conduits for electric conductors." C. H. Pugh, Ltd., and G. F. Bull. (Date applied for under Rule 13, December 4th, 1908. An invention comprised in Application No. 26,232, dated December 4th, 1908). May 6th.

10,757. "Improvements in and connected with switches." C. P. Elieson. May 6th.

10,772. "Improvements in oscillation detectors." G. W. Pickard. (Date applied for under Sec. 91 of the Act, March 25th, 1909, being date of application in United States.) May 6th. (Complete.)

10,791. "Improved electrolyte for primary or secondary galvanic batteries, applicable also as an emulsion for photographic negatives and as an electrolytical resistance for electric currents of any order." G. Schauli. May 6th. Complete.)

10,793. "Improvements in or relating to the production of electric currents." (Graf) B. Schwerin. (Date applied for under Sec. 91 of the Act, May 7th, 1908, being date of application in Germany.) May 6th. (Complete).

10,799. "Improvements in or relating to dynamo-electric machines or electro-magnetic power devices." A. K. Toulmin Smith. May 6th.

10,805. "Suspension jack for use on electrical and mechanical cranes and all hoisting tackle." A. Butler. May 7th.

10,834. "Means for and method of manufacturing depolarisators of galvanic batteries." W. J. Fahn. May 7th.

10,860. "Improvements in junction boxes for electric wires and cables." S. W. Martyn. May 7th.

10,868. "New or improved automatic electric current regulator." W. J. Blenheim and A. A. Vaughan-Williams. May 7th.

10,876. "Improved method and apparatus for the utilisation of Hertzian electric waves." J. H. M. Valoris. (Date applied for under Sec. 91 of the Act, October 28th, 1908, being date of application in France.) May 7th. (Complete.)

10,911. "Improvements in electrolytic apparatus." J. T. Niblett. May 8th.

10,913. "Improvements in means for charging and discharging electric accumulators on traction or lighting and like circuits." A. M. Taylor. May 8th.

10,925. "Improvements in magnetic compasses for preventing errors of steering, and for indicating the course to be steered." L. Nicholas. May 8th.

10,934. "Improvements in prepayment apparatus for the supply of gas, electricity or the like." J. Hansford and J. F. Wright. May 8th.

10,940. "Improvements in and relating to time switches." H. H. S. Marsh. May 8th.

10,955. "Improvements in and relating to electric resistance conductors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 8th.

EXPIRING PATENTS.

We are informed by Messrs. W. P. Thompson & Co. that about 750 complete applications for electrical patents were filed during the year 1895. Only 48 of the patents granted on these applications have been maintained for their full term—viz., 14 years; these being of considerable value, we give short abstracts of them below:—

148. January 2nd, 1895. "Electric meters." O. B. Shallenberger.—Relates to energy and quantity meters of the motor and electromagnetic types, specially applicable for use with multiphase alternating currents. Consists, in the motor type, in recording the number of revolutions of a conducting disk, &c., caused to revolve by the action of two sets of coils on opposite sides of the disk. One set is traversed by the whole or part of the alternating current to be measured, and the other set by currents which differ in phase from those in the first set, the motion being effected against the drag due to the passage of the disk, &c., through one or more magnetic fields. Various methods of arranging the coils to meet special requirements are described.

437a. January 7th, 1895. "Electric lamps." J. B. Barton. (W. Jandus.)—Relates to arc lamps. In order to prolong the life of the carbons, the arc is enclosed in two globes, so arranged that it is surrounded by inert or non-oxidising gases. The upper part of the outer globe is air-tight, while the lower part permits of some communication with the outer air. The inner globe permits of a limited communication between the inner and outer chambers.

533. January 8th, 1895. "Lightning arrester." R. Belfield. (Westinghouse Electric and Manufacturing Co.)—Relates to lightning arresters formed of a bar of lignum vitæ having transverse shallow grooves formed by means of a hot iron between conducting bars.

1,611. January 23rd, 1895. "Electrically lighting, heating and ventilating vehicles." E. J. Preston and A. B. Gill.—The dynamo is suspended from the frame, and is driven by a belt from the axle. The tightness of the belt is adjustable. When the speed of the vehicle increases unduly, the belt slips so that the dynamo keeps a constant speed. A switch for making and breaking contact, and maintaining the direction of the current when the direction of the vehicle is reversed, is described. Several arrangements for operating a resistance switch, and an electromagnetic arrangement for governing the lubrication of the bearings, are described.

1,731. January 24th, 1895. "Secondary batteries." C. A. Faure and F. King.—The electrodes consist of a conducting support covered with active material. A layer of silicated asbestos covers and protects the active material, and is itself protected by a perforated insulating celluloid or ebonite sheath. The silicated asbestos is prepared by repeatedly dipping asbestos fabric, such as asbestos paper, into a 5 per cent. solution of silicate of soda and exposing it to the air, so as to deposit silica on the asbestos fibres.

2,430. February 4th, 1895. "Electric conductors." G. G. M. Hardingham. (Felten & Guilleaume.)—Relates to electric conductors which are insulated by means of polygonal or other angular twisted tubes of paper, &c. The conductor runs straight through the tube, and is insulated chiefly by the air space. The paper, &c., tubes are formed by a rotating die or folded, having a central opening for the conductor. The conductors may afterwards be formed into a cable and taped.

2,913. February 9th, 1895. "Controlling electromotors." J. Devonshire. (E. D. Priest.)—Relates to a method of, and apparatus for, controlling electromotors operated on the series-parallel system. The apparatus shown consists of a commutating or controlling cylinder adapted to revolve continuously in either direction, and a resistance-switching cylinder, which reciprocates about its axis. The same handle operates the commutating cylinder and the resistance-switching cylinder. As the commutating cylinder is turned in one direction the resistance is gradually reduced. At all times when there is liability of sparking the path of the current is arranged to pass round "blow-out" magnets. The arrangement is such that resistance is thrown in and the circuit then opened before each of the changes of connection, while the circuit is opened and resistance then thrown in after each of the changes of connection.

3,096. February 12th, 1895. "Telegraphs." H. H. Lake. (World Flash Co.)—Relates to transmitting apparatus for sending Morse, &c., signals. A toothed driving shaft has on it a number of loose toothed contact rings each provided with insulating blocks which divide its periphery into portions corresponding to the currents sent for the Morse code. The contact rings are normally held free from the driving shaft by keys; when a key is depressed the ring is dropped on to the shaft and rotates with it until a pin causes the release of the locking mechanism which holds the key down. When a signal is to be repeated several times a finger key is employed for holding the mechanism free.

4,577. March 4th, 1895. "Lamps." W. Ackroyd and W. Best.—Relates to miners' safety lamps. When it is required to light the lamp it is placed within a frame, in which a strong battery and a condenser and induction coil are arranged. Upon completing the battery circuit by a switch, sparks pass between an insulated terminal and the wick tube to ignite the wick, the electrical circuit being completed through the metallic parts of the lamp.

5,279. March 12th, 1895. "Fire-alarm system." F. E. Stuart.—Alarm systems for street fire signals, &c., are arranged so that the signal shall be distinct from any signal received from any accidental cause. The transmitter is provided with a rocking pendulum, the upper horns of which in their normal position do not touch two springs connected to line and earth, but when the pendulum swings the circuit is closed between the two springs by one of the horns. This contact is alternately made and broken, the pauses between the signals becoming greater and the signals shorter as the pendulum comes to rest.

5,331. March 13th, 1895. "Electric meters." J. Devonshire. (W. C. Fish.)—Relates to meters of the motor type for strong currents. A shunt armature is carried by a shaft provided with a damping device consisting of a copper disk which rotates in a field produced by permanent magnets. A field coil may be provided to overcome the friction with a light load.

5,798. March 19th, 1895. "Motor winding mechanism." J. Burry.—Printing telegraph receivers, clocks, chronographs and other apparatus driven by spring or weight motors, have those motors automatically wound up by the action of a magnet, the circuit of which is closed by the printing signals or by pre-arranged contacts.

5,867. March 20th, 1895. "Railway signals." H. J. Pryce and L. de M. G. Ferreira.—Relates to electrical apparatus for signalling from one signal cabin to another on railways worked on the block system. The current for operating the visual indicator in the next signal cabin is caused to pass through the line wire, in one or the other direction according to the signal to be given, by means of a commutator which is operated by rotating a knob. To ensure that an audible signal shall be given with the visual signal, the spindle of the knob is normally locked in position by a pin on the ringing key, so that it is necessary to press in the key, thereby completing the bell circuit between the contacts before the commutator can be operated. A plate on the spindle of the knob bears indications, such as "train on line," "line clear," and "line closed," and according to the position of the commutator, the proper indication is exhibited. An arrangement to give a greater range of movement to the needles, &c., of the signalling instruments, and to hold them more steadily in their neutral positions, is described. For instruments used on single roads, or at junctions, a locking device is employed to prevent signals being given for up and down trains, or for trains approaching on converging lines at the same time.

(To be continued.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Apparatus for Producing and Utilising Electrical Effluvia. L. Gerard. 1,263. January 18th. (Date applied for under International Convention, April 19th, 1907.)

Electric Switches. C. Lillicrap. 8,752. April 22nd.

Electrical Storage Batteries. G. R. Carpenter. 8,794. April 22nd.

Rotary Interrupters or Switches for Electric Circuits. J. Gunning. 8,863. April 23rd.

Ignition Arrangements for Internal-Combustion Engines and other Purposes. H. A. Humphrey. 8,966. April 24th. (Application for Patent of Addition to No. 2,509/07.)

Starlike Trolley for Electric Railways and Tramways. A. Wermann. 9,099. April 27th.

Metallic Fittings for Electric Continuity System. L. Vaughan and C. Birch. 9,537. May 2nd.

Alternating-Current Regulators. L. Donati. 10,577. May 15th. (Date applied for under International Convention, May 15th, 1907.)

Conductor Rails for Electric Railways and the like. C. H. Merz and S. G. Redman. 11,347. May 25th.

Point Shifting Arrangements for Electric Tramways and the like. J. P. Tierney and J. Malone. 12,923. June 17th.

Electric Lampholders. W. Fennell and W. Perry. 13,230. June 22nd.

Tool for Seizing Incandescent Lamps by means of a Sucking Action. P. G. Triquet. 13,449. June 24th.

Device for Earthing or Metallic Continuity of Slip Socket Conduits for Electric Wires. G. Evans. 14,656. July 10th.

Vapour Lamps. R. D. Cody. 15,089. July 16th.

Electric Battery Lamps. Van Raden & Co. and M. Metz. 15,979. July 28th.

Electric Arc Lamps. Jandus Arc Lamp & Electric Co. and A. D. Jones. 16,151. July 30th.

T-Pieces for Conduits Used with Electric Conductors. E. Reinhardt, P. Reinhardt and S. Weil. 19,286. September 14th.

Process of Repairing Electric Metal-Filament Incandescence Lamps. H. Sefton-Jones. (H. Küzel.) 20,715. October 1st.

Electric Light Stand. J. F. Pierce. 21,602. October 12th.

Sparking Plug for Internal-Combustion Engines. M. Wild. 21,757. October 17th.

Trolley Heads or Collectors for Electric Traction. F. Kompe. 22,168. October 20th. (Date applied for under International Convention, October 22nd, 1907.)

Devices for Attaching Electric Wire Conductors to Insulators. C. Schroter. 27,075. December 14th.

Lamp Supports and Casings, Particularly Designed for Use with Electric Incandescent Lamps. J. S. Highfield. 27,991. December 23rd.

1909.

Means for Balancing End Thrusts in Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., United States.) 1,651. January 23rd. (Date applied for under Rule 13, August 18th, 1908.)

Holders for Electric Lamps. W. Green. 2,106. January 28th.

Rotary Field Magnet Consisting of Separate Permanent Bar Magnets for Multipolar Electrical Machines having a Stationary Armature. E. Volkers. 6,187. March 15th. (Date applied for under International Convention, April 23rd, 1908.)

Electrical Measuring Instruments. M. Francois. 7,198. March 25th. (Date applied for under International Convention, April 11th, 1908.)